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ABSTRACT

This ecology curriculum for young children is arranged into seven chapters of activities. The chapters are preceded by an activity matrix that provides information on outcomes, location of activity, and time of year. Each chapter begins with a background section that provides a basic understanding of the topic. It also explains how much young children can be expected to understand about the subject based on their developmental stage. Each activity includes a text box providing information on specific life skills emphasized, group size, materials needed, location, duration, and other information. The activities themselves are a combination of games, scientific experiments, and opportunities for creative expression. Activities explore such topics as tree functions, ecosystems and habitats, sun energy, food chains, wetlands, natural cycles, weather, ecosystem succession, renewable and nonrenewable resources, and decomposition. A glossary is included. (PVD)

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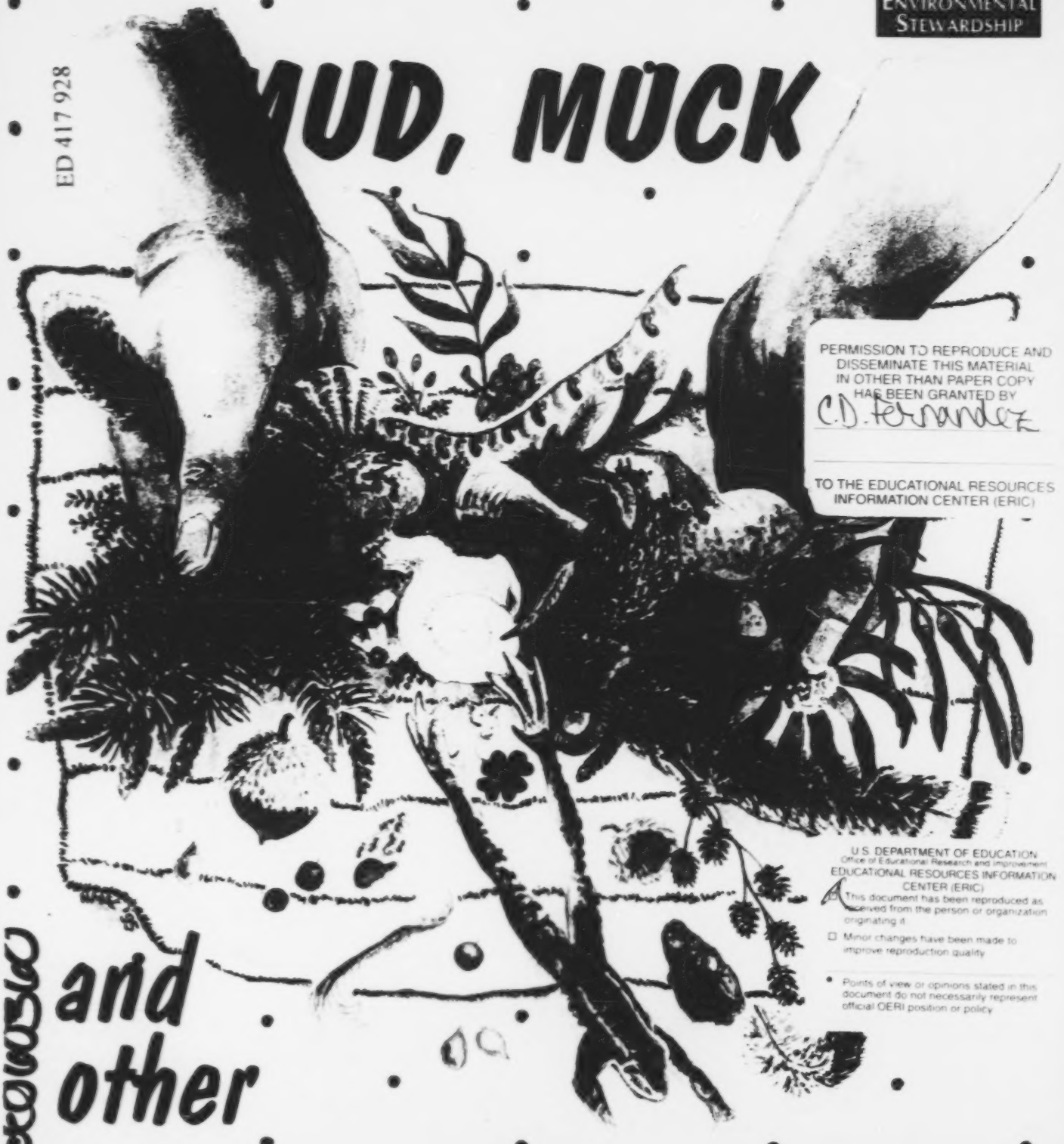
ENVIRONMENTAL STEWARDSHIP

MUD, MUCK



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and other WONDERFUL THINGS.

An Environmental Curriculum for Five- to Eight- year Olds

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Contents

Introduction 1

How To Use This Material 2

Working With Five- to Eight-Year Olds 3

Chapter 1 In My World 8

1 ☀ Tree Bees 9

1 ☁ Pond Puzzle 12

1 ☾ SunPower! 15

Chapter 2 It's Alive! Or Is It? 18

2 ☀ BioBingo 19

2 ☁ It's Alive!!!!! 22

2 ☾ Balloon Plants 24

Chapter 3 Habitat Is a Place to Hang Your Home 27

3 ☀ Habitat Match 28

3 ☁ Mud n' Muck 31

3 ☾ The Ants Go Marching 33

Chapter 4 We All Need Each Other 36

4 ☀ Whatta Web! 37

4 ☁ Wetland Webs 40

4 ☾ Makers, Eaters, and Breakers 44

Chapter 5 Cycles and Flows 47

5 ☀ Ice Cubes Away! 48

5 ☁ Let It Snow, Let It Snow, Let It Snow 50

5 ☾ Ocean Energy 53

Chapter 6 Blowing in the Wind 55

6 ☀ Seed Sock Hop 57

6 ☁ Old Field 59

6 ☾ Sun Lovers and Shade Lovers 62

Chapter 7 Can It Grow Again? 64

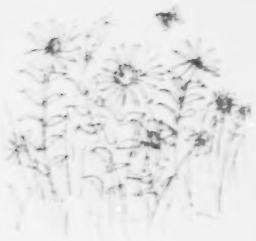
7 ☀ Tree Nurseries 65

7 ☁ Rock Gardens 68

7 ☾ Where Does All the Wood Go? 69

Glossary 72

Credits



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Introduction

It seems that today there are fewer and fewer opportunities for children to discover how the natural world works. Generations ago children would spend their days in the fields with their working parents, watching snow geese fly or willows turn yellow in the cold November winds. Today children often spend more of their time indoors, missing the lessons of the earth. Yet our dependence on our natural world and the resources it provides is as great as or greater than ever.

To inherit the wind, children first need to understand basic ecological concepts. Water cycles from earth to sky and back again. Energy comes from the sun, and flows one way through a system. Trees grow, are cut, and grow again. Decomposers return nutrients to the soil where they can be used again. Spiders are not insects. The world is chaotic. The world is biologically diverse. The world changes. Without understanding such basic concepts, how can we expect children to be good stewards of the land? How can they know what effect their actions will have on a habitat?

As an educator, you can help children read the world. Learning ecology is as important as learning ABCs. You also have the ability to help children use the power of wonder. Children are serious scientists. They observe and hypothesize and are eager to share their observations and hypotheses. Birds live in trees so their eggs don't get smashed by people. Earthworms live underground because they like the dark. Encourage all the theorizing you can in this age group. You will be helping to develop true stewards of the world, and gaining new insights into the world around you.

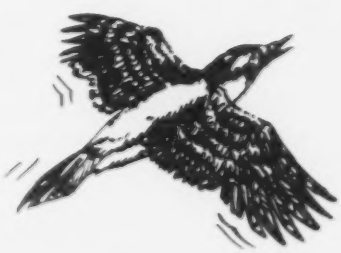
How to Use This Material

This curriculum is arranged into seven chapters. Each generally builds upon knowledge from the previous chapters. Therefore, it is best to start with Chapter 1 and work up to Chapter 7.

Each chapter begins with a background section that provides a basic understanding of the topic. It also explains how much young children can be expected to understand about the subject based on their developmental stage. Read the background and share any of the information you deem pertinent with the children as you do the activities.

Each activity includes a text box that provides information. This includes specific life skills emphasized, group size, materials needed, location, duration, and other important information. The activities themselves are a mixture of games, scientific experimentation, and opportunities for creative expression. Some are for 7- and 8-year olds only because the concepts may be too difficult for younger children. Others require the ability to read. Most recommend an adult-to-child ratio of 1:6.

The "Being a Steward of the Environment Means. . ." section at the end of each activity is meant to be read to children by a teacher or leader. Many of the ideas make excellent group projects and extensions to the learning. Try some!



Working With Five- to Eight-Year Olds[1]

Children ages five to eight present an interesting challenge for environmental educators. The development of stewardship behaviors is an important goal, but may be difficult to achieve when children are struggling to tell the difference between things that are alive and not alive. Little material exists for this age group that specifically addresses basic ecology, critical thinking skill development, and stewardship behavior.

At an early age, children's interests are focused upon their immediate environment. Five- or six-year-olds cannot see themselves removed from their backyards, bedrooms, or classrooms. Young children concentrate on themselves as the center of a small universe.

Children ages seven to eight have a tendency to view humans as passive participants in nature—they do things in the environment, not to the environment. It's important that any learning materials stress the role that humans play in changing nature.

Developmentally, five- to eight-year olds have special characteristics and capabilities. The chart on the next page summarizes these traits and the implications for program delivery. If you have worked with these age groups before, the characteristics may appear familiar.

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[1] Adapted from National 4-H Curriculum Manual for Youth K-3, National 5-8 Curriculum Task Force.

General Characteristics and Capacities of Children Ages Five to Six

Category	Characteristics	Implications
Physical Development	Physical growth slower than when an infant. Muscle coordination uneven and incomplete—large muscles easier to control than small ones.	Plan activities that use large motor skills. Introduce fine motor skills one at a time. Maximize physical activity. Use experiential learning.
Cognitive Development	Concrete thinkers. Think literally. Egocentric (self-centered) and have an inflated sense of importance. Define things by their use. Just learning letters and words. Generally have a short attention span.	Ask and answer questions in literal terms. Give instructions verbally and visually. Use real objects as opposed to pictures.
Emotional Development	Sensitive to criticism and don't accept failure well. Cooperative, helpful, and affectionate. Like routine. Say what they think and feel.	Provide encouraging words. Give opportunities to help in meaningful, real ways. Give clear descriptions of activities and stick to a schedule. Gear activities toward success and mastery.
Social Development	Prefer to work in groups of two or three. Like to focus on their own work and play. Like being part of and around a family. May be bossy or unkind. Can engage in group discussions.	Organize projects that involve two or three children. Develop projects that involve or focus on the family. Avoid competitive activities that select a winner or best person.

General Characteristics and Capacities of Children Ages Seven to Eight

Category	Characteristics	Implications
Physical Development	Physical growth is slow and steady. May still be inept at using some small muscles. May need to repeat an activity many times to master.	Provide patient guidance and encouragement for fine motor activities—cutting, hammering nails, etc. Let them practice large motor skills.
Cognitive Development	Beginning to see perspectives of others. Love humor, and have a curiosity and delight in discovery. Becoming organized. Do some limited abstract thinking. Most can read simple instructions.	Give instructions verbally and visually. Plan activities that require sorting, collecting, organizing, or classifying. Plan activities that let them get their hands moving.
Emotional Development	Enjoy being part of the family. Worry about failure and criticism. May claim tasks are too hard rather than admit to being scared.	Make gifts for the family. Doing things for others. Be sensitive when teaching a new concept or skill.
Social Development	May be moody and have high expectations of adults (criticize parents). More outgoing, curious, and talkative than younger children. Beginning to internalize adult feelings toward religion, money, etc. Beginning to develop friendships that involve sharing secrets and possessions. Pick same-sex playmates.	Select activities that involve children's curiosity and creativity. Promote social activities that emphasize diversity. Use a variety of songs, stories, and comics to help socialize the group.

Activity Matrix

Activity	Outcomes	Indoor/Outdoor Special Habitat	Time of Year[2]
TreeBees	To introduce the concept that nature is made up of parts that have various functions.	Outdoors Single tree needed	Any—spring best
Pond Puzzle	To introduce basic components of an ecosystem, including animals, plants, and abiotic factors such as water, soil, and sunlight, and the relationships within the system.	Indoors or at an optional wetland site	Any
SunPower!	To understand that the sun warms and provides energy to the earth.	Outdoors anywhere	During warm weather
BioBingo	To explore abiotic (nonliving) and biotic (living) items in nature using the five senses.	Outdoors in a semi-natural area with bushes and trees preferred	Any
It's Alive!!!!!	To explore the things that living creatures need to stay alive.	Outdoors in a semi-natural area where group has permission to take plant samples	Spring, summer, or fall
Balloon Plants	To understand that living plants need water, soil, sunlight, and carbon dioxide to grow.	Indoors	Any—length of days may affect germination
Habitat Match	To match organisms with their habitats.	Indoors	Any
Mud N' Muck	To find and identify organisms that use pond soil as their habitat.	Indoors or optional at a pond, marsh, or other wetland	During warm weather
The Ants Go Marching	To recognize that ecosystems contain habitats that support diverse populations of plants and animals. To observe and list a variety of arthropods.	Outdoors near bushes, trees, rocks, etc. Asphalt, alleys, etc., also will work	During warm weather

[2] **For all but tropical climates. In locations such as Florida and Hawaii you may be able to do activities during the entire year.**

Activity	Outcomes	Indoor/Outdoor Special Habitat	Time of Year
Whatta Web!	To introduce concepts of food chains and webs.	Outdoors anywhere or in large indoor space	Any
Wetland Webs	To simulate a simple aquatic food chain.	Outdoors anywhere or in large indoor space	Any
Makers, Eaters, and Breakers	To understand the roles of makers (producers), eaters (consumers), and breakers (decomposers).	Indoors or outdoors	Any
Ice Cubes Away!	To observe and describe evaporation.	Outdoors anywhere	During warm or hot weather
Let It Snow, Let It Snow, Let It Snow	To understand that events in nature have a repeating pattern.	Indoors	Any
Ocean Energy	To trace the flow of energy through an ecosystem.	Indoors	Any
Seed Sock Hop	To investigate how seeds move from one location to the next.	Outdoors at an overgrown lot or wooded area	Spring, summer, or fall
Old Field	To gain awareness of how ecosystems undergo succession.	Indoors	Any
Sun Lovers and Shade Lovers	To understand that ecosystems such as forests, wetlands, and prairies change over time.	Outdoors near a woodlot or group of trees	When leaves are on trees
Tree Nurseries	To investigate whether trees can be grown again.	Indoors and outdoors near seed-producing trees	When seeds are ripe—spring, summer, or fall
Rock Gardens	To differentiate between renewable and nonrenewable.	Indoors or outdoors	Any
Where Does All the Wood Go?	To understand decomposition and nutrient recycling in a forest.	Indoors and outdoors at a forest	Fall

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Chapter 1 In My World

Chapter Background

What is the world like to a child? Young children are the suns of their own small universes. They perceive the world from a self-centered view, learning more and more about the world by touching and doing. The world to a young child is literally a backyard away.

A child is curious about and is stimulated by this world. Bees buzz. Caterpillars crawl. Squirrels scatter. Branches break. Because of the child's self-centered view, all these actions are performances for his or her own enjoyment.

Children ages five to eight can learn that there are things in their world that are shared by others. The same sun shines on a field in Taiwan and a playground down the block. The sun, the stars, and some patterns and processes are common to everything and everyone. Eventually, a child will blend these parts into a picture of nature.

In the activities in this chapter, children start out exploring a single item in nature. They then look at a larger system. The entire earth can be considered an ecosystem—a geographic unit that contains living plants and animals that interact with one another and with the environment. A trickling brook and its watershed can be considered an ecosystem. Seven- or eight-year-olds may understand the idea of an ecosystem, although they may label it "nature." They know there is a wholeness of nature, and that there is some give and take, some interdependencies in this system.

North America has many major ecosystems with general commonalities. These differ from one another in terms of climate and topography. They also differ markedly in the species of plants and animals they support. Quaking aspen and balsam fir may shelter ruffed grouse. Big bluestem and goldenrod may provide important habitat for red foxes and prairie skinks. Chaparral may harbor rattlesnakes. Children ages six and older can begin to describe and understand the relationships within these ecosystems. They also can begin to grasp the value of different ecosystems for different species.

Urban areas occur in these major ecosystems. However, they also have been substantially altered by humans. A street in downtown Phoenix may not resemble the desert, and a housing development in Chicago may not contain deciduous forests. But urban areas are environments and can be studied as such.

In the last activity, children will look to the wide universe to explore the power of the sun. On earth, we depend on the sun for our energy. Our planet intercepts some of the energy that flows from the sun. This constant addition of energy from the sun is balanced by the loss of radiant energy from earth into space. Living and dead organisms store some energy for a while. This energy may end up being used for food or fuel. By studying the sun and it's awesome energy, children begin to look beyond their small world and explore the great big wonderful universe!

Activity 1 Tree Bees

Life Skills: trying new things, building a base of experience, expressing creativity, listening, working together cooperatively, sharing, gathering information to solve problems, asking questions, using large muscles, refining small motor skills

Size of Group: any

Ages: five to eight

Minimum Adult-to-Child Ratio: 1:6

Location: indoors and outdoors near a tree

Time Needed: 25 minutes

Best Time of Year: Spring, but anytime will work

Materials: copies of Activity Sheet 1, paper bags, crayons or markers, glue, pencils. Optional: lens boxes or magnifying glasses

Objective

To introduce the concept that nature is made up of parts that have various functions.

Activity Summary

Children examine a tree while pretending they are "tree bees". (Many bees collect pollen from flowering trees. These bees are dubbed "Tree Bees" to engage the children's imaginations.) Children collect samples from the tree of things tree bees need. In small groups, they examine their collectibles and share ideas on how bees would use them and what they do for the tree. They then complete Activity Sheet 1.

Doing the Activity

To start this activity, tell the children that they will become tree bees. Ask them to describe what tree bees might be like. What do they do all day? What noises do they make? How do they get around? Explain that tree bees are explorers that search nature for things they can use or eat.

Divide the children into teams of two to four each. Explain to teams that they will be visiting the tree that tree bees like to explore the best. That's because this tree has many, many things that tree bees find interesting and can use. Give each team a paper bag.

Visit a tree. Any tree will work, but one with leaves, catkins, flowers, or seeds might be the most interesting. (You may wish to let each team examine a different type of tree.) Explain to teams that they will be collecting things a tree bee might need. If they like, they can pretend to be tree bees, buzzing around the tree and collecting items. They should put these things into their bags. Tell them to be careful not to damage branches or bark.

As they collect samples, children will have many questions, such as "What's this?" or "Why does this have a hole in it?" Encourage their questions, and ask them to come up with plausible explanations. You don't have to know all the answers. You can, however, be a resource if they want to find an answer using field guides or other references.

After they have finished collecting and exploring their tree as tree bees, let each team examine the items they have collected. They can use magnifying glasses

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or lens boxes if they wish. They should try to answer two questions about each item:

- How could it be used by a tree bee?
- What does it do for the tree?

Give each child a copy of Activity Sheet 1. Ask children to glue some of their items onto the pictures. They also can draw other parts of nature to finish the picture. If they can write, they will want to fill in the sentences at the bottom.

Give the children several minutes to make their discoveries and color. Let them share their pictures with other teams, either formally or informally. Ask children if they found anything a tree bee could eat. Anything it could use for shelter? What other interesting things did they find on the tree? Why does a tree have these things?

Evaluation

Describe three different things found on a tree. What do they do? Do bees or other animals sometimes use these things? How?

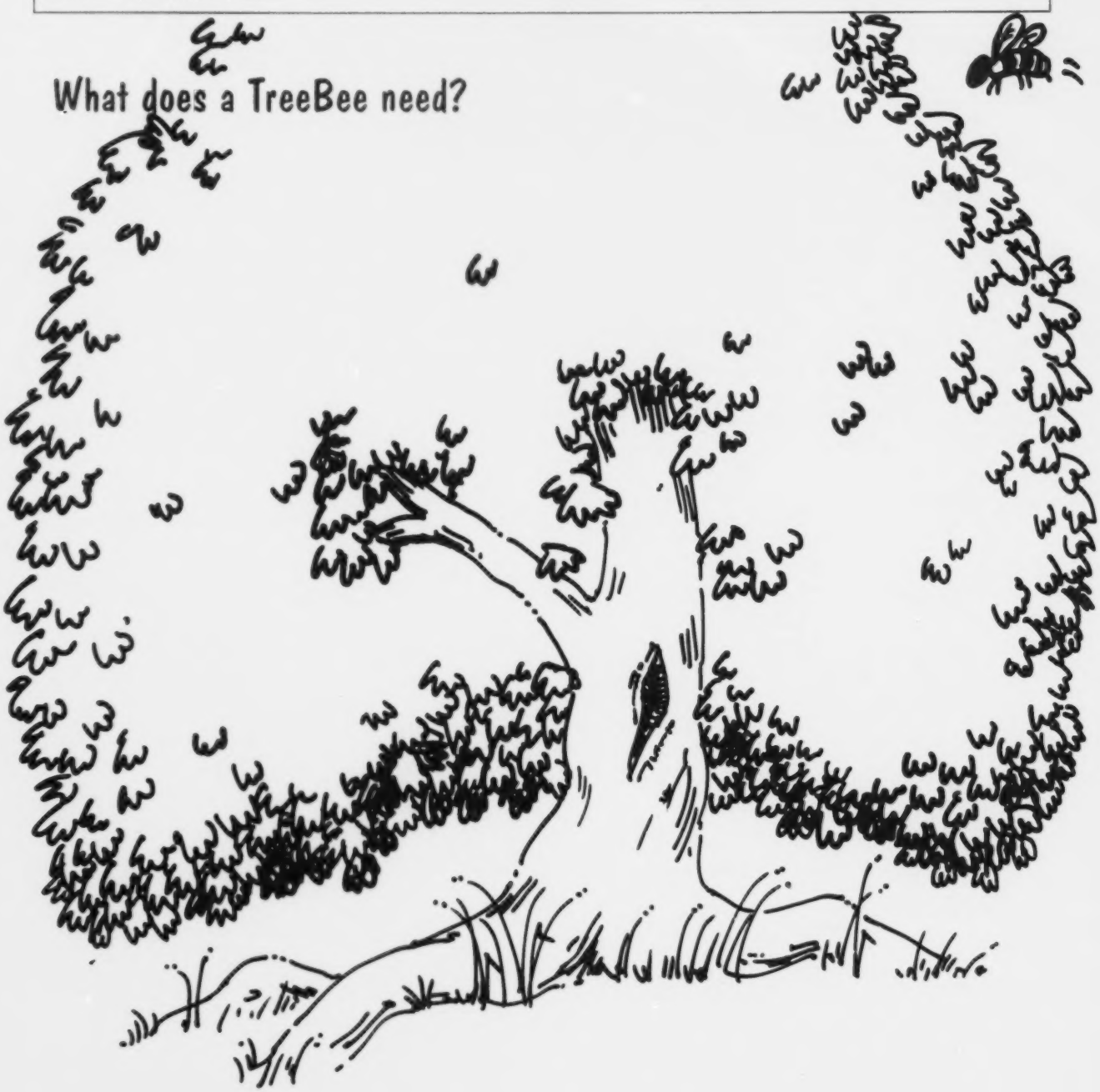
Being a Steward of the Environment Means . . .

understanding that in nature, every type of animal, plant, and other living thing has a role to play. Trees are very important as homes and as sources of food. So take care of trees! Trees need water, especially in the summer. Give a tree near your home a bucket of water every week during warm weather. Someone in your family can help you get water in the bucket. This will help keep the tree healthy!

TREE BEES

MY NAME IS:

What does a TreeBee need?



My FAVORITE tree is a: _____

It's important because: _____

Activity 1 Pond Puzzle

Objective

To introduce basic components of an ecosystem, including animals, plants, and abiotic factors such as water, soil, and sunlight, and the relationships within the system.

Activity Summary

Children compare their immediate environment with an aquatic ecosystem. They list items in their world that fall under the categories of animals, plants, and other important things. They then make a similar list for a wetland ecosystem, discussing similarities and differences. They color and cut out a puzzle that shows the importance of each component of an ecosystem.

Doing the Activity

You may want to review the "What Needs What" table found at the end of this activity before starting. It will give you examples of how living things in a wetland need each other.

You can do this activity indoors or outdoors at a wetland site. Start by writing the following headings on a chalkboard or large piece of paper:

animals
plants
other important things

Ask the children to name different animals, plants, and other important things in their neighborhood or backyard. Let them give several examples. In some urban areas, children may not be able to think of many animals and plants right away. You may want to use questions to prompt them, such as "Are there any animals in the air?" or "Are there any plants growing between the cracks in the sidewalk?" Record responses in the appropriate categories with the children's help.

Now ask participants if they have ever seen a pond (marsh, swamp, wetland). Using the same categories, have them name plants, animals, and other important things they've seen there. (You can have the children close their eyes and imagine the things they might find at a pond—you may want to play a recording of nature sounds to help them visualize the wetland.) Continue this for a few minutes. If you are at a wetland site, they can use their senses of touch, smell, sight, and hearing to help come up with ideas.

Compare the two lists (read them aloud to nonreaders). Name several animals from the first list, and ask children if they

Life Skills: trying new things, building a base of experience, expressing creativity, listening, developing intellectual curiosity, refining small motor skills, learning to use tools and other objects

Size of Group: any

Ages: five to eight

Minimum Adult-to-Child Ratio: 1:6

Location: indoors or outdoors at a wetland

Time Needed: 45 minutes

Best Time of Year: any

Materials: copies of Activity Sheet 1, crayons or markers, chalkboard and chalk or large paper pad and markers, scissors

would find them in a pond. Let the children discuss why or why not. You may want to reinforce that a pond is wet, and animals and plants that really need water live in there. Repeat this for plants and other important things.

Ask the children if a pond ecosystem could survive without one of the items from your list. For example, if "fish" is on your list, ask if a pond would stay the same without fish. Does anything on the list eat fish? What might happen to these animals without fish? What things from the list do fish eat? Would there now be more or less of these creatures? Discuss several of the animals, plants, and other items from their list in this way.

Ask the children to think back to the list of the things in their backyards (or neighborhoods). Which things could they live without? Which are very important? What would happen if some of the "pieces" to their backyard was lost? Would it look the same?

Pass out copies of Activity Sheet 1. Let children color and cut out their pond, then put the puzzle back together. What happens if one of the pieces gets lost? Is the picture the same? Does it look different? Does it make a complete picture anymore?

Evaluation

Name some animals, plants, and other things in or around your neighborhood. Are they important? Why or why not? Could you live outside at a pond or do you prefer your bedroom? Why? Could a duck live in your kitchen? Why or why not? Can you name some other types of plants, animals, and other important things from an area you've visited that are different than the ones already named (e.g., cactus from desert, alligator from swamps)?

Being a Steward of the Environment Means . . .

keeping all the pieces together. Draw a picture of your street, backyard, or a nearby natural area. Cut the picture so that there are many pieces. Now try to fit the puzzle back together again. What would happen if you lost a piece? Every part of the puzzle has a purpose!

What Needs What?

Tiger swallowtail (butterfly) needs. . .	Willow, alder, or aspen tree
Spider needs. . .	Plants to spin a web between
Largemouth bass needs. . .	Small minnows and other fishes for food
Dandelions need. . .	Sunlight to grow
Crayfish need. . .	Tiny plants and animals for food
Microscopic water bears (Tardigrades) need. . .	Fresh water or they shrivel and stay dormant
Mudpuppies need. . .	Fishes, insects, and crayfish for food
Painted turtles need. . .	Rocks and logs to sun themselves on
Green water snakes need. . .	Frogs to feed upon
Wood ducks need. . .	Tiny aquatic plants such as duckweed for food
Red winged blackbirds need. . .	Tall plants to perch upon
Cattails need. . .	Wind to spread their seeds

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POND PUZZLE

Color this picture of a pond, then cut apart along the lines. Try to put the puzzle back together.

Activity 1 SunPower!

Life Skills: trying new things, building a base of experience, listening, working together cooperatively, gathering information to solve problems, practicing problem solving, learning by using the five senses, developing intellectual curiosity, identifying resources, predicting outcomes of situations, refining small motor skills, learning to use tools and other objects

Size of Group: any

Ages: five to eight

Minimum Adult-to-Child Ratio: 1:6

Location: indoors and outdoors, during warm weather

Time Needed: 45 minutes

Best Time of Year: spring, summer, or other warm weather

Materials: copies of Activity Sheet 1, pencils, thermometers, clear plastic cups, tap water

Objective

To understand that the sun warms and provides energy to the earth.

Activity Summary

Children measure the temperature of water before and after exposure to the sun, comparing it to a sample that wasn't exposed. They also use the sun's energy in their own created experiment.

Doing the Activity

This activity is a series of experiments to test whether the sun warms the water and other parts of the earth.

Start by asking the children where they get their energy to move. From the moon? From rocks? From cookies? Children should be able to reply that they get energy from food. Let children name the types of food they eat to get energy—they may want to hypothesize which type provides the most energy (candy . . . pizza . . . hot dogs?).

Explain that although we use food for energy, that energy has to come from someplace. It comes from the sun. The sun gives us heat and light. This energy helps plants grow. We eat plants. Other animals eat plants. Without the sun we would have no food.

Experiment One: Warm Water

Explain that children will be scientists and test whether the sun provides energy to the earth. Separate children into teams of two, assigning one adult or teen per three teams. Give each team a copy of Activity Sheet 1 for recording their observations. Show them how to take temperatures using thermometers. Younger children can test temperature using their sense of touch. They can "guess" at the temperature. It's only important that they understand which glass of water is warmer.

Let each team fill two clear plastic cups with tap water (they should be the same temperature). Help teams measure or guess the temperature of each sample. Have them record the temperature in columns one and two on Activity Sheet 1.

Ask teams how they could change the temperature of the water using the sun. Use one of their ideas or put one sample outside directly in the sun. Leave

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the other sample indoors or put it outside in the shade.

After ten minutes, let teams again take the temperature (or estimate) of each sample and record their responses. Did the sun warm the water? How do they know? Is the sun using energy to heat the water? Does the sun provide heat energy to the earth?

Let teams report their scientific observations to the rest of the group. Were the teams' results similar? How much warmer is the sun-warmed sample than the other? If you would like to do some basic math with your seven- or eight-year olds, have them calculate (with your help):

- the difference in temperature between their samples
- the highest and lowest class measurements and the difference between the two

Ask the children why it's important that the sun warm the earth. Does the sun make lakes boil? Why or why not? What types of animals and plants do they think prefer cold water? Warm water? What would happen if all water were the same temperature? Would we lose some types of living things?

Experiment Two: You Test the Sun!

In teams of two, ask the children to design an experiment to test the sun's heating power. For example, can the sun warm or cook food (like an oven or microwave)? Can it warm people like a heater? Can it help plants grow—is it important to living things? Does it warm dark or light surfaces more quickly? Let teams conduct their experiments (or try them at home if you don't have the supplies). Be sure they get a chance to share their ideas with other members of the group!

Evaluation

Does the sun warm the soil and water on the earth? Have you ever climbed into a car on a cold, sunny day and found it was warm? Why or why not? What would life be like without the sun? Would there be any energy to grow plants? Could we live without the sun? Why or why not?

Being a Steward of the Environment Means . . .

saving energy! The energy we use in our homes may come from fossils—animals and plants that have been dead for a very long time. But there is only a limited supply of these fuels. If you turn out lights, you save a little bit of energy for someone else to use. And your household saves some money!

SunPower!

Water Temperature

	GLASS ONE (SUN)	GLASS TWO (NO SUN)
FROM THE TAP		
10 MINUTES LATER		

My Own Experiment:

I'm going to do: _____

_____

_____

What I think will happen: _____

_____

_____

What really happened: _____

_____

_____

Why I think that happened: _____

_____

_____

Chapter 2

It's Alive! Or Is It?

Chapter Background

A brown, twisted oak leaf blows across a yard under a gray October sky. A five-year old spies the leaf and chases it, finally clutching it from the air. The child is convinced she has just danced with a living sprite.

Young children have the very strong sense that anything that moves is alive. Experience and age help children gradually to understand that not everything in their yard is active and aware. By age seven or eight, children instinctively know the difference between living (biotic) and nonliving (abiotic) things. However, the lines become a little blurred when they try to differentiate between nonliving and once-living. The brown leaf that danced in the wind is dead, but it once contained living cells. It was once alive.

Living things generally grow, require energy, reproduce, respond to stimuli, change, and die. They often move. Living things are made up of cells that are alive. Water is a combination of the nonliving elements hydrogen and oxygen. Water itself is not alive. But put a drop of pond water under the microscope, and watch the activity! Many creatures, big and small, live in water.

Living things may move and grow, but that doesn't make them human. Cartoons and movies may portray animals as walking, talking, and riding bicycles. Young children may draw flowers or suns with smiling faces to reflect their pleasure with the goodness of nature. But by the age of six or seven children begin to understand that petunias don't pout and dinosaurs don't dance.

Living things depend upon each other. Many animals need plants to survive. Many plants need animals to survive. Plants and animals also depend on bacteria and fungi. Besides their dependence on each other, living things also depend upon nonliving things such as water, air, and soil.

In this chapter, children will explore living and nonliving things and how they depend upon one another. They will investigate what living things need to grow and thrive. Young children will begin to understand the difference between living and nonliving. They will see that some nonliving things were once alive. And they will discover that even nonliving things sometimes move in the wind.

Activity 2 BioBingo

Life Skills: trying new things, building a base of experience, learning by using the five senses, developing intellectual curiosity, working together cooperatively

Size of Group: any

Ages: five to eight

Minimum Adult-to-Child Ratio: 1:3

Location: outdoors

Time Needed: 30 minutes

Best Time of Year: spring, summer, fall, or adapt BioBingo squares for winter

Materials: copies of Activity Sheet 2, markers or colored pencils

Objective

To explore abiotic (nonliving) and biotic (living) things in nature using the five senses.

Activity Summary

Children play BioBingo, finding items outdoors that match the game squares.

Doing the Activity

Pick an area for the activity that has several trees and bushes. Also choose a designated space such as a large rock or a tree that will serve as the BioBingo base.

Seat the children in a circle or other comfortable arrangement. Ask if anyone can name something in nature that is living. Make sure that several children get to respond. Now ask the children to name something that is nonliving. If you need to, explain the term nonliving. Some nonliving things (e.g., rocks and rain) were never alive. Other nonliving items (e.g., sticks on the ground) were once alive but have died. You may want to discuss how to tell living and nonliving things apart, i.e., whether they grow, need energy, reproduce, respond to stimuli, move, etc. (see Chapter Background).

Pass out a copy of Activity Sheet 2 to each child along with a marker or pencil. Pair nonreaders with adults or teens. Explain the rules of BioBingo: Children are to try to find things that fit into the categories on the sheet. They write the names of things (or draw pictures) of the things they find in the appropriate squares. When they have three in a row, either across, diagonal, or up and down, they are to run back to the base (show this to them) and yell "BioBingo!" Be sure to explain that they shouldn't collect the item.

Explain that they also can choose to work in teams of two, and only need to fill out one sheet. However, they must hold hands at all times to keep the team together. Let them choose to work alone or find a partner.

At this point, turn the children loose to hunt for their items. Be sure to keep children from getting lost or running into the street. You may want to preface this step with a discussion of boundaries. Your adult and teen helpers also can help keep children safe and out of streets.

When children or teams reach the base and yell "BioBingo," they should give their worksheet to the adult in charge, then take a fresh sheet and hunt again. While this activity is competi-

tive, it does not result in only one winner. Any child or team reaching the base should be congratulated on finding three in a row. All children should be congratulated for participating. Let the children play the game for several minutes.

Bring the group back together. Ask them to share what types of things they found to fill in the squares (go square by square and take many responses). Ask which category they thought was the hardest to fill. The easiest? Was it easier to find living or nonliving things? What did children smell while they were doing the activity? What did they hear?

Ask the children if they think teams or singles found more BioBingos (you can keep track by counting the sheets you've collected). Was it hard for teams to stay together? Did team members always agree on where to go and what to write?

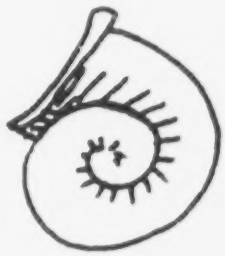
Ask the children if they think living things are important in the environment. What about nonliving things? Can anyone think of a way in which living things use nonliving things? Let the children name some examples of nonliving things in nature that they need.

Evaluation

Did the groups correctly identify living and nonliving things on their sheets? If not, you may want to review the terms again. Did the children who chose teammates work together cooperatively? Ask the children: What do living things have in common? How are nonliving things different from living things?

Being a Steward of the Environment Means . . .

thinking about where animals live. Often nonliving things are homes for animals. A pile of rocks or a wood can be a home for lizards or a resting place for a chipmunk. Water is home to fish, ducks, and other animals and plants. Soil is home to earthworms, bacteria, and other creatures.



ACTIVITY SHEET 2

GREEN AND LIVING	GRAY AND NONLIVING	SMOOTH AND NONLIVING
MAKES A BUZZING SOUND AND LIVING	STICKY AND LIVING	CAN'T SEE IT AND NONLIVING
CRAWLS AND LIVING	MAKES A RATTLING SOUND AND LIVING	SMELLS GOOD AND LIVING

BIO-BINGO

Activity 2 *It's Alive!!!!!!*

Objective

To explore the things that living creatures need to stay alive.

Activity Summary

Children select different living and nonliving items outdoors. They investigate if there is anything they can do to help the nonliving thing change or grow and try to keep the living thing alive.

Doing the Activity

Visit an outdoor site with your group where you have permission to dig and collect samples. A small woodlot or wetland area is ideal. A vacant lot on a city street also is suitable, as long as your group has permission to use the lot.

Ask the children if they can tell when something is alive. What does it do? How do they know it is alive? How is it different from something that is nonliving?

Let each child collect one living plant. Explain that they are going to keep their plants alive. Give children small containers and spoons or trowels. Have them dig the plant from the ground, keeping the roots intact, and place it with soil in the container. Be sure that there are enough adults or teens to help.

Help the children identify their plants' needs by observing conditions where they were found. Does it need sun or shade? Water? Soil? This information will help them design a way to keep the plants alive.

Now ask children to each find an object that is nonliving. They should carefully transport both living and nonliving things back to the meeting site.

Challenge the children to keep their plant alive for at least two days. What does the plant need? Do plants need the same things as animals? Let each child devise a way to keep their plant alive. Give children soil, water, food material, or whatever else they identify that plants can use. Set up an area so that the plants can be observed.

Next ask children to try to bring the nonliving things they collected to life. Ask them to water, feed, and provide shelter and space for the nonliving thing the same way they do for the living items. If they water their plants, then they also should water the rocks. The living and nonliving thing should be placed next to each other.

Children are completely respon-

Life Skills: trying new things, building a base of experience, expressing creativity, listening, gathering information to solve problems, practicing problem solving, developing intellectual curiosity, asking questions, identifying resources, predicting outcomes of situations, refining small motor skills

Size of Group: any

Ages: five to eight

Minimum Adult-to-Child Ratio: 1:6

Location: indoors and outdoors

Time Needed: 45 minutes initially; several days to finish the different experiments

Best Time of Year: spring, summer, or fall

Materials: trowels, soil, containers (paper cups, milk carton bottoms, pots, etc.), water, other materials as identified by teams. Optional: field guides, garden books, other references

sible for the care and feeding of the living and nonliving thing. They should respond to any problems—e.g., if plants are about to dry out, they need to water them.

Throughout this activity, provide opportunities for children to ask questions about the care of their living and nonliving things. If you're not sure of the answer (do daisies need sun or shade?), help them find information in gardening books, field guides, or other sources. They may have creative ideas (e.g., feeding dandelions marshmallows). Help them understand whether their ideas are sound, but don't quash their attempts to hypothesize. Trying to figure things out through observation and trial and error is a hallmark of a good scientist.

After two days, let the children share their living and nonliving items with the others. Did the plants stay alive? Was it hard to figure out what they needed to stay alive? Did the nonliving things become alive? What did each child have to do to keep their plants alive? Did the nonliving things grow or change? Did they move? Did the living things grow or change?

Help children replant their living things outdoors.

Note: Sometimes, a few of the plants will die during the course of the activity. You may choose to shorten this activity to a few hours to ensure that just about everything will stay alive. Or you may choose to use the activity to talk about life and death, and about how living things die if their needs aren't met. It's your decision.

Evaluation

Do living things move and grow? Do they need to eat? Do they need shelter? Light? Shade? Where do nonliving things come from? Do they grow, move, or eat?

Being a Steward of the Environment Means . . .

helping provide food and shelter for living things! Make a bird feeder. You'll need a cardboard paper towel roll, some peanut butter and vegetable shortening, a ribbon, and some birdseed. Poke a hole on one end of the paper towel roll. Mix a few spoonfuls of peanut butter and vegetable shortening together until creamy. Spread the mixture on the paper towel roll. Sprinkle birdseed over the roll. Thread the hole with a ribbon. Hang your bird feeder outside for sparrows, chickadees, and nuthatches to enjoy. Use a book to try to identify all the birds that visit your feeder! Note: the bird feeder makes a great gift for a parent or friend!

Activity 2½ Balloon Plants

Objective

To understand that living plants need water, soil, sunlight, and carbon dioxide to grow.

Activity Summary

Children work in teams to explore what plants need to grow. They fill balloons with potting soil. They drop radish seeds into the balloons, then add water and carbon dioxide and hang their balloons in the sun. They observe their balloons as the seeds sprout. Note: younger children may wish to use large, clear plastic bags instead of balloons for this activity.

Doing the Activity

During this activity, your group will be further exploring what living things need. The "It's Alive!!!!!" activity is recommended as a pre-activity. Children should understand that living things need food and water.

Ask the children if they know where plants get their food. Do bushes walk around grocery stores with carts? Do flowers order pizza by phone? Let the children volunteer answers. This will give you an idea of how much your group understands about photosynthesis.

Summarize that plants need water and sunlight to make food. They also need a gas in the air called carbon dioxide. Animals let this gas out of their lungs when they breathe. Ask the children to take a deep breath. Now ask them to blow hard, holding their hands in front of their mouths. The air that is coming out is carbon dioxide. Plants need this air to grow. (Be sure they don't confuse this gas with the type they put in their cars. Carbon dioxide is invisible; gasoline is not.)

Explain that the group members are going to be scientists. They will test whether plants need water, sunlight, and carbon dioxide to grow. They will do this by growing balloon plants!

Break the group into teams of two. Give each team a clear balloon, 1/2 cup of potting soil, several radish seeds, a small quantity of water, a ribbon, and copies of Activity Sheet 2½. Help them prepare their balloon plants using the instructions from the sheet. For children younger than seven, give verbal step-by-step directions. Older children should be able to follow the written directions, although they will still need adult or teen guidance. It's best to have an

Life Skills: trying new things, building a base of experience, working together cooperatively, gathering information to solve problems, developing intellectual curiosity, predicting outcomes of situations, refining small motor skills

Size of Group: any

Ages: five to eight

Minimum Adult-to-Child Ratio: 1:2

Location: indoors

Time Needed: 30 minutes initially; up to two weeks for seedling germination

Best Time of Year: any

Materials: copies of Activity Sheet 2½, large clear balloons (available at party decoration or paper warehouse stores), markers, ribbons, funnels, measuring cups, washcloths or wipes, radish seeds, sterilized potting soil, water, ceiling hooks or other places in front of window to hang balloons

Note: it is important that the balloons be easy to inflate because they will contain soil, seeds, and water. You may want to stretch or otherwise prepare the balloons so that they can be easily blown. (Younger children can use large, clear sandwich plastic bags instead of balloons.)

adult or teen helper for every team to ensure that the balloon is not jostled or turned upside down during the preparation.

After they have finished, ask the children what they gave the plants to help them grow (sunlight, water, and carbon dioxide. The soil anchors the plants and provides nutrients. Soil does not provide food to plants—food is defined as energy, and nutrients do not provide energy. Plants make the only food they can use with water, carbon dioxide, and energy from the sun.) Do they think the balloon plants will grow?

Be sure to answer any questions the children have about plants and food making. If you aren't sure of the answer, become a learner! Find the answer from a nature guide, science text, or other resource together.

In a few days, have teams check the balloons. Have any of the seeds sprouted? After about five to ten days, have teams chart the progress of their seeds. They should observe that plants are beginning to grow.

Ask children where plants outdoors get water. Do they get sunlight? Where do they get carbon dioxide? How big do you think the plants in the balloons could get? Could they grow in the balloons forever? Will they run out of carbon dioxide or water? Does anyone have plants at home? What would happen if you forgot to water them? Give them sunlight?

Option: Let each team try one of the following experiments on a new balloon plant. Follow the directions given except:

- Don't add water. Do the seeds germinate?
- Use helium to blow up balloons. Can plants use helium to grow?
- Put the balloon in the dark. Do the plants grow?
- Don't add soil. Do the seeds germinate? Do the plants grow?

Evaluation

Where do plants get food? Where do plants get carbon dioxide? Do plants need water to survive? If you breathed on all of the plants in your home, would they grow better? (Probably not, since there is plenty of carbon dioxide in air.) Can you name the living things within the balloon? Nonliving things?

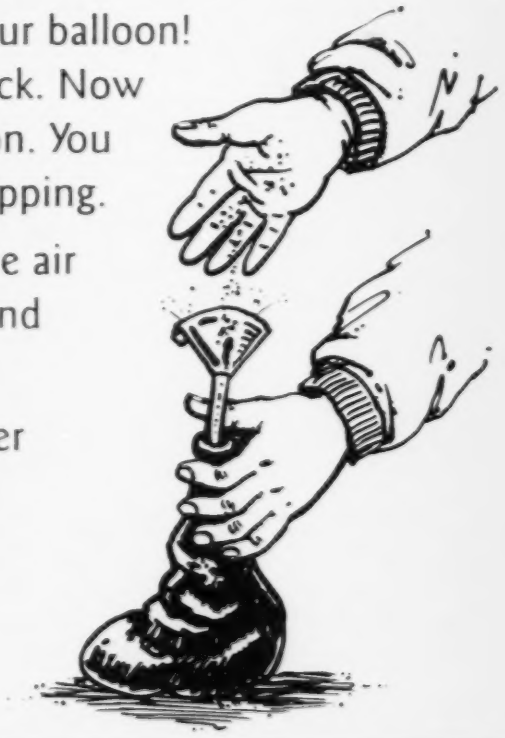
Being a Steward of the Environment Means . . .

taking care of plants! We give plants carbon dioxide to live. But plants give us something we need, too . . .oxygen! Oxygen is an invisible gas in the air. Without oxygen, we would die. You can take care of plants around your home. Outside, make sure that trees, bushes, and gardens get enough water, especially when the weather is hot and dry. Inside, help water plants—but be sure to ask permission first!

BALLOON PLANTS

Here's how to make your own

1. Hold a balloon firmly by the neck. The neck is the long part. Use a funnel, and pour 1/2 cup of dirt into the balloon. Don't turn the balloon over.
2. Keep holding the balloon by the neck. Add about 1/4 cup of water through the funnel. Be sure the soil in the balloon is wet. It shouldn't be soggy, though.
3. Use the funnel to drop the radish seeds into the balloon. Don't turn the balloon over.
4. If the balloon is dirty, wipe it carefully with a washcloth.
5. Now you're ready to blow up your balloon! Keep holding it gently by the neck. Now carefully blow air into the balloon. You need to keep the balloon from tipping.
6. Tie a knot in the neck to keep the air in the balloon. Tie a ribbon around the knot.
7. Tie the balloon to a hook or other place near a window. The neck should be the top.
8. Your balloon plant is ready to begin growing!



Chapter 3

Habitat Is a Place to Hang Your Home

Chapter Background

Almost all living things need food, space, shelter, sunlight, and water in their habitat. Habitat is a place where organisms try to meet their survival needs. A room filled with games, books, and candy might make up the preferred habitat of most five-year-olds.

By age five or six children should be able to tell whether a brown bear could be found swimming deep in the ocean. They should be able to reason whether a gaggle of geese could nest in an apple tree, or whether an alligator could live in a garage or on a fire escape. Of course, the answers to these are generally no. All animals and plants have specific needs for food, shelter, space, and water. They need these things to thrive. If an alligator could find food, water, shelter, and space in a garage or on a fire escape, it could live for many years!

Animals and plants have certain features that help them live in their habitat. Channel catfish have barbels, or feelers, near their mouths. These barbels help them find food in murky water where they can't rely on sight. Lodgepole pine have cones that are sealed with a waxy substance. These cones need lots of heat or fire to open. The lodgepole pine is well adapted to survive the intense, quick fires that characterize its habitat.

Biological diversity is critical to a healthy habitat. In nature, diverse places are strong places. For example, in Oregon and Washington, old growth temperate rain forests contain a plethora of species, all adapted to take advantage of the rich habitat. Animals, plants, and fungi live under logs, on tree trunks, under the shade of ferns, alongside creeks, and everywhere else imaginable. Compare this variety with a pine plantation or urban lawn. There is nowhere to hide! The structure of such a habitat is too predictable—only a few species can live in such a place.

One of the most prevalent types of animals on the earth is the arthropod. Arthropods include insects and spiders. Since they are so abundant, they are easy for children to inventory and explore. More information about diversity and arthropods is found in Activity 3[illegible].

Children can attract animals and plants by creating a complex habitat. No more neat and boring! Rock piles, brush piles, standing dead trees, logs, and other things add interest to a habitat. You can add to the biological diversity of a city street or lot by planting trees, flowers, and bushes native to the area.

Young children will explore big and small habitats in this chapter. They'll look at habitats far away and as close as a handful of mud. Children also will explore their home habitat, to understand how it meets their unique needs.

Activity 3 ☀ *Habitat Match*

Objective

To match organisms with their habitats.

Activity Summary

Children explore their own habitats and match animals with habitats using the cards found on Activity Sheet 3☀.

Doing the Activity

Start by asking the children to describe their homes. They can take turns telling about their houses and apartments. Do they get food at their home? A warm place to sleep? Can they get water if they need it at their home? Do they have enough space to sit quietly or to move around?

Now ask children to think of their favorite animals. Where do those animals live? Ask each child to name his or her animal and describe its habitat—where it lives, finds food and water, and seeks shelter and space. Ask if the animal could live in the child's bedroom. (Possibly, if it's a dog or cat.) Could the child live in the animal's habitat? Why or why not?

Separate children into teams of two. Give each team a card deck from Activity Sheet 3☀. Briefly discuss each animal and habitat with the children. For example, you may say "Here is a picture of a mouse. Where would it live? Under water? Up high in a tree? Or in a field where it can find food?"

After you have introduced all of the animals and their habitats, the teams can play a couple of simple games to match the animal with the correct habitats:

Game One: Wildlife Memory

Shuffle the cards and lay them out, one by one, face down on a hard surface. Take turns turning up two cards. If you make an animal-habitat match, keep the cards and take another turn. If the cards don't match, turn the cards back over and let the next person take a turn. (To make it easier, put the animal cards in one area and the habitat cards in another.)

Game Two: Matches

Shuffle the cards and place them in a pile. Take turns drawing a card until a player gets an animal-habitat match. Lay the match face up on the table. Continue until all of the cards are drawn. Then take turns picking from each other until all the cards are paired.

Life Skills: trying new things, valuing diversity, listening, sharing, practicing problem solving, developing intellectual curiosity, refining small motor skills

Size of Group: any

Ages: five to eight

Minimum Adult-to-Child Ratio: 1:6

Location: indoors or outdoors

Time Needed: 25 minutes

Best Time of Year: any

Materials: a set of cards from Activity Sheet 3☀ for each team of children (laminate, if desired)

Evaluation

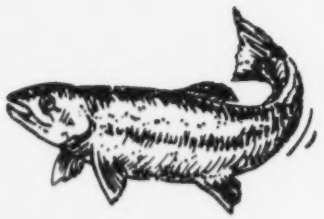
What types of things do plants and animals need in their habitat? Could a manatee survive in the desert? Could a trout nest in a tree? Why or why not? What types of animals live in our area? What type of plants live in our area? Do we ever lose habitat? How? What happens if just one part of habitat (e.g., food) is lost? Could the animal still survive?

Being a Steward of the Environment Means . . .

creating shelter for animals! Shelter is an important part of habitat. You can make nest boxes to provide shelter for many different birds. Here are the sizes for different types of birds:

Bird	Entrance Hole Size	Floor Size	Box Depth
House Wren	1 inch	5 inches x 5 inches	10 inches
Nuthatch	1-1/2 inches	5 inches x 5 inches	10 inches
Sparrow	1-1/2 inches	4 inches x 4 inches	10 inches
Chickadee	1-1/4 inches	4 inches x 4 inches	8 inches

You'll need some wood, a saw, and some nails. You can get more detailed plans from your local department of conservation or natural resources or your local cooperative extension office. The library and bookstore also have information on building nest boxes.



RAINBOW TROUT

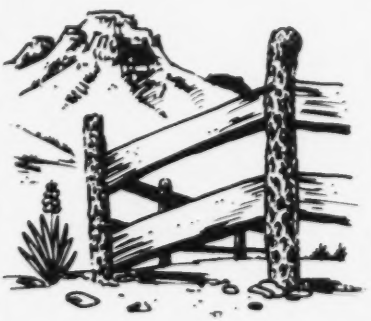
WHITE FOOTED MOUSE

HUMAN

FENCE LIZARD

DOWNY WOODPECKER

MONARCH BUTTERFLY



Activity 3 Mud n' Muck

Life Skills: trying new things, building a base of experience, listening, working together cooperatively, developing intellectual curiosity, asking questions, refining small motor skills, learning to use tools and other objects

Size of Group: any

Ages: five to eight

Minimum Adult-to-Child Ratio: 1:4

Location: outdoors near a marsh or indoors

Time Needed: 50 minutes

Best Time of Year: spring, summer, or fall in northern climates

Materials: boots, shovels, plastic garbage bags, newspapers, magnifying glasses, clear plastic drinking glasses, plastic wrap, rubber bands. Optional: pond field guides

Objective

To find and identify organisms that use pond soil as their habitat.

Activity Summary

Children collect marsh or pond soil using shovels. They examine the soil with their hands to find different organisms.

Doing the Activity

This activity can be done one of two ways. You can travel to a marsh or wetland with participants and complete the activity at the site, or you can bring indoors several shovelfuls of pond muck (bottom soils and detritus) from urban or rural wetlands. Keep the pond muck outside and moist until you need it. The explanation below assumes you will be visiting a wetland. Adapt it as appropriate if you plan to work indoors.

At the wetland, ask the children to name the place they are visiting (marsh, wetland, bog, swamp, etc.). Can they name an animal or plant that lives here? Let them give as many examples as they can. Ask where the animals live in the wetland. Underground? In the water? Explain that they will be exploring a wetland habitat. Grab a handful of pond muck. Hold it up, and ask how many think living things need mud for shelter or food. Let the children discuss their ideas.

Separate children into teams of two. Give each team a shovel and plastic garbage bag. Instruct them to scoop one large shovelful of pond muck into the bag. Pair every two teams with an adult or teen leader to ensure their safety near the water. Have teams bring their samples to an outdoor or indoor area where the rest of the activity will take place.

Give each team several sheets of newspaper, plastic wrap, rubber bands, clear plastic cups, and magnifying glasses (optional). Using their hands, team members should spread the mud and muck onto the newspaper. They should then gently separate and comb through the muck and look for small creatures such as worms and spiders.

Patience is definitely required for this activity, along with the ability to play in the mud! Most of the teams should find insects, frog eggs, or other small creatures. Once they find a living thing, they can examine it with a magnifying glass or put it into a clear cup for viewing. (You

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may need to place a small piece of plastic wrap with a rubber band around the cup.) Give the children some time to explore this new habitat and its creatures. You may want to give older children pond field guides to help them identify living plants and animals.

Let the children share the items they found. Where did they find them? Were they hiding? What are they (insect, spider, eggs, worm, etc.)? Why were they on the bottom of the marsh? Why weren't they floating on top of the water? Were the children surprised they found so many creatures? What do these creatures eat?

Ask the children if they liked digging through the mud with their hands. Would they like to live in the mud? Would they like to find their food in the mud? In what kinds of places do humans live? What kinds of things do humans eat?

After all samples have been viewed, let teams return the organisms to the muck. The muck can be returned to the wetland.

Evaluation

Why would living creatures be found in mud? Is mud living or nonliving? How do animals depend on mud? What would happen if there weren't any cool, mucky mud in wetlands? Where does the mud in wetlands and marshes come from? Besides mud, what other kinds of habitat can you describe?

Being a Steward of the Environment Means . . .

watching wetlands! Marshes are a cool place for ducks and other birds to get together! In the spring, ducks and geese like to lay eggs in nests in and around wetlands. If you're lucky, you can see a mother Canada goose with her goslings (baby geese). Or you might see ducks diving to find food. What other things do you see at a wetland?

Activity 3 *The Ants Go Marching*

Life Skills: trying new things, building a base of experience, listening, valuing diversity, working together cooperatively, developing intellectual curiosity, learning to use tools and other objects

Size of Group: any

Ages: five to eight

Minimum Adult-to-Child Ratio: 1:6

Location: outdoors

Time Needed: 30 minutes

Best Time of Year: spring, summer, or fall in northern climates

Materials: copies of Activity Sheet 3, pencils. Optional: magnifying glasses or hand lens

Objective

To recognize that ecosystems contain habitats that support diverse populations of plants and animals. To observe and list a variety of arthropods.

Activity Summary

Children inventory arthropods (small animals including ants, spiders, etc.) using Activity Sheet 3. They categorize them according to how they move.

Doing the Activity

Arthropods are joint-legged animals that have a segmented external skeleton. These include crustaceans (e.g. crayfish), insects, spiders, and mites. About 95 percent of the species in the United States are very small organisms such as arthropods and microbes. Arthropods contribute to the biological diversity of their habitats. (Note: if your group is very young, you may not want to use the term arthropod. Substitute living thing or small creature. Try not to call these organisms bugs or insects as a catchall phrase. Spiders, mites, and earthworms are not insects. And just to add to the confusion, earthworms are animals but are not arthropods. They are annelids!)

Start by asking children if they think there are many different types of animals and plants on the earth. What about in a single habitat, such as a forest? Do they think there are more insects, spiders, and mites than plants? Than bigger animals? Explain to the group that insects, spiders, and other small creatures make up one of the biggest groups of living things in the world. Why do they think there are so many of these small creatures on the earth? (Because there is proportionally more habitat!) Let the children know that during the activity they will be searching habitat for these small living creatures. They will count and classify the animals, much as a scientist would.

Separate the children into teams of two. Pair readers with non-readers. Each team will use Activity Sheet 3 to tally the types of arthropods they find. They don't have to identify the creature; instead, they will differentiate types by their ability to crawl, walk, hop, or fly.

Outside, give each team a copy of the sheet (and optional magnifying glass or hand lens). One child will be the recorder for the team. He or she will put a single

slash in the appropriate column for each type of insect or other small creature they find. The team should not count the same type of animal more than once.

Ask the children to think like very small creatures. Where would they live or try to find food? Under rocks? On leaves? Under bricks? On the bark of trees? In the grass? Encourage teams to think small to find their creatures. Give them several minutes to conduct their inventory.

Bring the teams back into a large group. Have each describe the creatures they found and where they found them. Where did they find the most animals? Why did they like this habitat? Did the teams find arthropods that had wings off the ground? Did they find any that crawled on the ground?

Ask the children if they think there were more small creatures than they found. Do they think there are lots of these creatures? Why are worms and arthropods important? What do they do? (Arthropod and annelid groups pollinate, aerate soil, decompose organic material, serve as food for other organisms, and provide other important functions to the ecosystem.)

Evaluation

Is it important to have lots of types of small animals in a habitat? Why or why not? What types of habitats do these creatures like the best? What types of food, space, water, and shelter do these habitats provide? Are there lots of arthropods in the world?

Being a Steward of the Environment Means . . .

discovering and learning about the different types of insects and spiders that live in your home! Even a house can be good habitat for a spider. If your home has unwelcome creatures, try to make the habitat less appealing. Get rid of food sources and things that may serve as shelter. Remember, though, that our homes contain zillions of little creatures that we can't see yet we live with them every day!

Optional:
If time permits, older children can compare creatures found in two distinct habitats. Let them look in a woodlot or wild garden where there is a diversity of vegetation and in a field or on a lawn. In urban areas, children can find insects and other creatures on sidewalks and compare them with those found on grass, bushes, or potted plants. Ask the teams to compare the amount of types of arthropods they found in each ecosystem. Where did they find the most types?

The Ants Go Marching

Count the different types of insects, spiders, and small creatures you find. Figure out if each crawls, walks, hops, or flies. Make a "\" mark in the appropriate category for each type you find.

Crawls	Walks	Hops	Flies

Chapter 4 We All Need Each Other

Chapter Background

A bright purple coneflower folds its petals back, twisting to meet the sun. The meadow surrounding the coneflower is bursting with blazing stars and sideoats grama grass. While it may seem as if this prairie is all show, it's actually hard at work. The green plants that live here are using sunlight to convert carbon dioxide and water into a simple sugar that is the basis of life.

These plants and others like them are producers, the first link in important interdependencies known as food chains. Food chains are important interdependencies in nature. Virtually all living things rely on algae, apple trees, alder, and other producers to make food through photosynthesis. These dependent creatures, known as consumers, can be herbivores (plant eaters), carnivores (animal eaters), or omnivores (animals that eat both plants and animals).

Decomposers comprise another important part of the food chain. They include arthropods such as insects, as well as fungi, bacteria, earthworms, and nematodes. Decomposers break down organic material (e.g., plant debris or dead animals), returning nutrients to the soil for later use by plants.

Food chains transmit food energy from one living thing to another. They come in two types. In one, energy is transferred from green plants to consumers. For example, pond duckweed feeds a hungry mallard, which in turn becomes a hearty breakfast for a mink. In another type of food chain, energy stored in nonliving organic matter is transferred to decomposers. An armadillo scavenges a dead meal from a Texas highway; earthworms eat organic matter, helping to enrich the soil.

These two types of chains link: organisms that die form the base of the second chain, which in turn provides nutrients to green plants, the base of the first. The result is a complex web of interactions. Humans are part of, and depend upon, these chains and webs.

Living things also depend on nonliving things. They depend on water, soil, rocks, and air. Animals and plants are highly dependent on the structure of their habitat. If the habitat changes, species must move, die, or adapt.

Most children know they depend on humans for warmth and sustenance. Some also may claim to "need" other things, such as television or candy, to survive. A five-year-old may truly need a favorite stuffed toy; an eight-year-old may need a best friend. But at these ages, children can begin to understand the differences between needs and wants. They can begin to understand how interrelated all of the living and nonliving things of the earth truly are.

Activity 4 ☀ Whatta Web!

Life Skills: trying new things, building a base of experience, understanding diversity, valuing diversity, practicing problem solving, developing intellectual curiosity, using large muscles

Size of Group: at least six children

Ages: five to eight

Minimum Adult-to-Child Ratio: 1:6

Location: indoors or outdoors

Time Needed: 25 minutes

Best Time of Year: any

Materials: large paper and markers or chalkboard and chalk, copies of Activity Sheet 4 ☀ (prepare tags by copying, cutting, and threading with a ribbon)

Objective

To introduce concepts of food chains and webs.

Activity Summary

Children brainstorm a list of animals and the plants and animals they eat. The children then become animals or plants by wearing name tags. They search for things they eat or that eat them and hold hands to create a food chain. Simulations show what happens when the food chain is interrupted.

Doing the Activity

Start by asking children to name animals and something they eat. Record their responses on a large paper or chalkboard. Let each child finish his or her thought without interruption. After a few examples, explain to the children that this is a brainstorm. There are a few simple rules to brainstorming:

1) everybody's ideas are important
2) nobody can say that some one else's idea is wrong
3) raise your hand if you have an idea

Continue your brainstorm. After a few minutes, ask the children to look at the list they generated. Are there many different types of animals and plants represented? Why do some animals eat plants? Why do some animals eat animals? What do plants eat?

Explain to the children that they will be playing a game to look at the things animals and plants eat. Pass out a tag (prepared from Activity Sheet 4 ☀) to each child. There are 15 tags provided; eliminate a few for smaller groups and make more for larger groups. The animal tags given here represent a typical urban food web or chain. You can adapt the food chain to your area by making your own tags or letting the children design some based on brainstorming. A field guide to local plants and animals can help you identify what animals eat in their natural settings.

In a large, cleared space indoors or outdoors, ask each "plant" and "animal" to find something it eats or something that eats it. They should then hold hands and go search for something else until they don't have either hand free. The children should keep holding hands the entire time. Explain that they are trying to make as long of a chain as they can.

After a few minutes take a look at their chain. Ask the children

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if they think they need each other. Does the mouse need seeds? Does the bat need mosquitoes?

Now, try a few of the following scenarios:

1) Foxes like to live in wild places. But new houses are being built in some woods. Many of the trees are being removed to make room for the houses. It isn't very wild anymore. And there are fewer trees to make seeds. (Remove the foxes. Remove some seeds.)

2) It has been a very, very cold winter. There is too little food for the number of mice. (Remove a mouse or two.)

3) There is a new road in town. It was built between two ponds. The frogs jumping across the road between the ponds keep getting squashed by cars. (Remove a frog or two.)

4) It's been a cold, wet year for snakes. They can't hunt as much because it's too cold. Some die. (Remove a snake or two.)

Be sure to discuss what happens to the food chain each time something is removed. Does it get stronger? Weaker? Are there some animals that don't have anything to eat? What else could they eat?

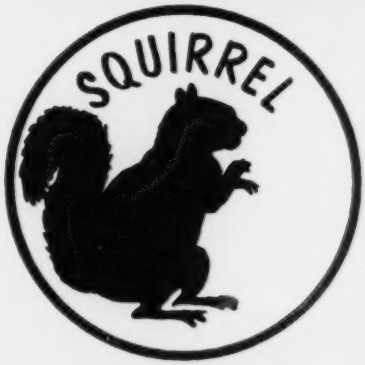
Ask your group to name a few animals and plants they depend on. Do they depend upon a dog for safety? Do they need trees for furniture and houses? Apples for food to eat? Do they need worms to make the soil better to grow more food? Would they like to trade places with a mosquito? A blue jay? A red fox?

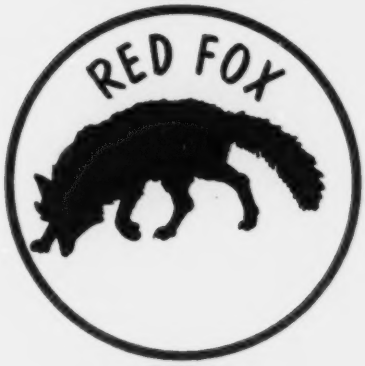
Evaluation

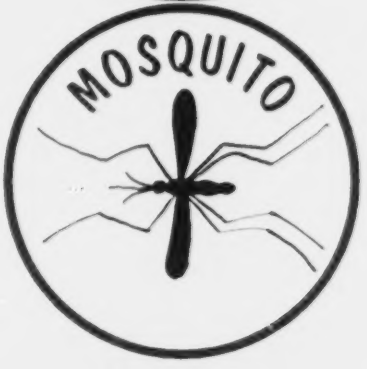
Do animals and plants need each other? How? Can you name an animal and something it eats? Can you name a food you eat and trace it back to an animal or plant? Do humans sometimes change habitat? Does nature sometimes change habitat?

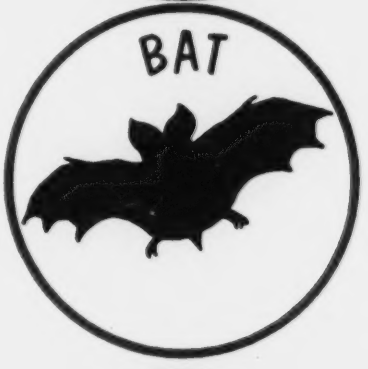
Being a Steward of the Environment Means . . .

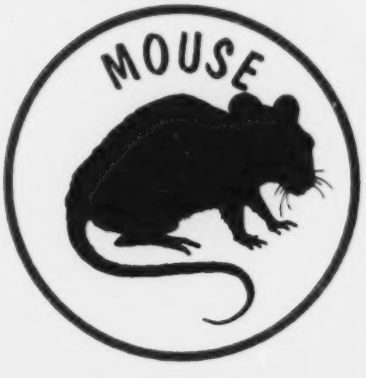
discovering how animals and plants need each other. Spend some time watching a rabbit or another animal (even an ant!). Does it use plants or trees to hide behind? Does it pick up sticks or small leaves to use for shelter or food? Does it chase other animals and use them for food? Write a story or draw a picture about the animal you are studying. Show it to a parent or other person in your house. Show it to a friend, too.











WHATTA WEB

Cut around each creature, then string into a necklace.

ACTIVITY SHEET 4

Activity 4 — Wetland Webs[3]

Objective

To simulate a simple aquatic food chain.

Activity Summary

Children play a game that simulates a pond ecosystem. Initially, only tiny wetland plants and mosquitoes are allowed into the pond. The mosquitoes feed on the plants (peanuts or popcorn). Eventually, frogs are introduced to chase and eat the mosquitoes. Finally, great blue herons swoop down to feed upon the frogs. The object of the game is to try to balance the ecosystem. Note: Children can shell and eat the peanuts after the activity, but they should not eat any popcorn that has been lying on the ground!

Doing the Activity

Activity 4 is strongly recommended as a pre-activity to introduce the concepts of food webs and chains.

Before you begin, make sure that tags are prepared (see text box). Also, establish the boundaries of the area in which the game will be played. Use masking tape or hula hoops to create three small circles that will be cover for animals being chased by predators.

Explain to participants that they will be spending some time as animals in a marsh. They will be building a simple food chain. Ask them to name an animal and something it eats in a wetland. Does anything eat that animal? Ask the children to define predator. Help by pointing out any predators they may already have named. What does a predator need to catch food? (large mouth, body parts for grabbing prey, chewing or sucking mouthparts, speed, brains, good eyesight, etc.)

Introduce children to their "wetland." Shower the wetland with peanuts or popcorn. Explain that these are really tiny, tiny plants that animals eat. Pick some mosquito volunteers—about half the group. Give them mosquito tags and "stomachs" (plastic bags). You might want to discuss what mosquitoes eat. Most children will answer "me!" but actually, male mosquitoes eat plant juices. Females do the biting at baseball games, but they also eat microscopic plants like algae.

Tell your mosquitoes that it's their job to eat the plants (pick up peanuts) until they have a full

Life Skills: listening, developing intellectual curiosity, using common sense, using large muscles

Size of Group: any

Ages: seven to eight

Minimum Adult-to-Child Ratio: 1:6

Location: indoors or outdoors (large open space needed)

Time Needed: 30 minutes

Best Time of Year: any

Materials: a large bag or two of peanuts or three to four gallons of popcorn, copies of Activity Sheet 4 (prepare tags by xeroxing, cutting and threading with a ribbon), sandwich bags, masking tape or hula hoops Note: for the most realistic representation, use three different sizes of sandwich bags—small for the mosquitoes, medium for the frogs, and large for the herons.

3 Adapted from Fishing . . .Get In the Habitat! Leader's Guide, MinnAqua Program, Minnesota Department of Natural Resources, 1992.

Option One:
Use two colors of popcorn for this game—one to simulate pollution. Don't tell the children what the colors mean until the game is over. Then explain that anyone with more than half of their popcorn a certain color is "contaminated." Be sure to talk about the types of pollution that aquatic organisms are likely to encounter. These include natural pollution such as mercury and sediment (although these are often made worse by human activity). They also include human-made substances such as pesticides and industrial chemicals. Explain that many of the most dangerous substances are no longer legal in this country, but still stay a long time in the soils of a lake, river, or wetland.

stomach (bag). Explain that they are consumers (eaters), and are part of a wetland food web. Let them loose to feed.

After a few minutes pass out a frog tag to most of the remaining children (reserve a few children to be great blue herons). Give each frog a stomach. Stop the mosquito feeders, and explain to the entire group that the frogs will be entering the system as predators. It is their job to eat (tag) the mosquitoes. When a mosquito is tagged, it must empty its stomach into the frog's stomach. It is then out of the game. The mosquitoes only hope is to jump into the cover circles. Frogs cannot tag them when they are in the circles. Release the frogs. (Note: if children get tired of being "dead," you can let them rehatch on the sidelines after a few minutes so they can rejoin the game.)

After about five minutes, pass out great blue heron tags to the remaining children. (Hint: don't make the largest or most aggressive members herons!). Give each heron a stomach. Again stop the game, and explain to the group that the great blue herons are predators of frogs. If a frog is tagged, then it must empty its stomach into the heron's stomach. The frog is then dead and out of the game (or can rehatch on the sidelines). Of course, the frogs also can seek shelter in the circles.

By now you should have a wetland where mosquitoes are eating plants, frogs are eating insects, and herons are eating frogs. Frogs and herons should not be eating plants (picking up peanuts) directly.

After several more minutes, call the group back together. Ask them to hold up their stomachs. What group has the most plants (peanuts or popcorn)? The mosquitoes? The frogs? The great blue herons? How many mosquitoes and frogs died (got tagged and sat out)? Who survived the best?

Ask the children how you could balance the wetland better. Do you need more frogs? More plants? More mosquitoes? Change the amount of players by changing tags according to the group's recommendations. Play the game again, and check for survival at the end. Try adding only one blue heron or many, many more frogs. Is the ecosystem balanced? Ask your group what might happen in real life to change the number of mosquitoes, frogs, or herons in a pond. How would this change the food web?

Evaluation

What would happen if the plants in the wetland died? What would happen if there were lots

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and lots and lots of frogs? Would there be enough food to support the animals? What happens in a real wetland to dead animals and plants? Which animal needs more food to survive (by volume)—a mosquito or great blue heron? Why are wetlands important?

Being a Steward of the Environment Means . . .

understanding that wetlands are important! Many parts of our country have lost almost all of their wetlands. They have been drained to grow crops or build roads and houses. Laws now protect many wetlands. If there is a marsh near your home, become a wetland watcher for a week. Does your wetland have lots of water? Just a little? Are there many different plants and animals? Can you find any frogs? Snakes? Beetles? Cattails? Other plants? Watch your wetland, and discover how wild it can be!

Option Two:
Dub this game "City Links" and use urban species such as worms, robins, and cats. You'll need to make your own tags. The popcorn or peanuts simulate organic material that the worm eats. The sparrows eat the worms, and the cats eat the sparrows. Again, try to balance your ecosystem. What happens if there are too may cats? Not enough worms? No sparrows? Will cats eat worms?

WETLAND WEBS

Activity 4 — Makers, Eaters, and Breakers

Objective

To understand the roles of makers (producers), eaters (consumers), and breakers (decomposers).

Activity Summary

Children discuss makers, eaters, and breakers. They also color Activity Sheet 4.

Doing the Activity

Start by asking the children if they eat plants or animals. Identify your group as eaters. Eaters can be humans, bears, dolphins, turtles, or other animals (and some plants, like venus fly traps). Ask the children to name some plants or animals that they eat. Now explain that plants are makers—they make food using a gas in the air (carbon dioxide) and water.

Now ask the children if anything eats dead animals and plants. They may name many scavengers—crows, opossums, etc. Explain that other things such as fungi, earthworms, and bacteria also use dead food. These breakers are important. They break down food so that plants can use the nutrients and grow again. (Note: you may want to show the children a breaker, such as a mushroom. You should be able to find interesting, colorful samples in a small forest or woodpile!)

Hand out copies of Activity Sheet 4. Children can color the sheet according to the directions. (Read the directions to nonreaders.)

After they have finished coloring the activity sheet, let children take turns sharing which things are eaters, makers, and breakers. Ask if they think there are many eaters on the earth. What about breakers? Makers? Are there different kinds of makers, eaters, and breakers? Ask the children to name every type of maker they can think of. You might want to write their responses where they can be seen by the group. Are there more kinds of eaters on the earth than your group can think of? (Probably. Costa Rica has more than 15,000 species of butterflies—eaters—alone.)

Display the finished activity sheets where they can be seen by everyone.

Evaluation

Can participants name makers (maples, roses, grass)? Can they name eaters (catfish, pelicans)? How about breakers (bread mold,

Life Skills: building a base of experience, understanding diversity, gathering information to solve problems, practicing problem solving, developing intellectual curiosity, refining small motor skills

Size of Group: any

Ages: five to eight

Minimum Adult-to-Child Ratio: 1:6

Location: indoors or outdoors

Time Needed: 20 minutes

Best Time of Year: any

Materials: copies of Activity Sheet 4, crayons or markers

Option: Let children draw pictures of their favorite eaters, makers, or breakers.

sowbugs)? What would the world be like without breakers? Without makers? Without eaters?

Being a Steward of the Environment Means . . .

reducing the amount of organic waste going to landfills or incinerators (places where we put garbage) by building a compost pile! Breakers will turn leaves, coffee grounds, eggshells, and other materials into rich organic matter called compost. You can then use the compost as fertilizer in your yard.[4]

To build a compost pile:

1) Find or build a wooden box that is 3 feet square and 1 foot tall.
2) Line the box with chicken wire. An adult can help you.
3) Put egg shells, coffee grounds, vegetable and fruit leftovers, grass clippings, etc., into the box. Don't put meat scraps into the box, because that will attract rodents and other pests.
4) Put the box outside. Stir the ingredients with a shovel or pitchfork every two weeks. Add more compostable materials when you have them. Add a little bit of water every now and then.
5) Depending on where you live, it takes about three to nine months to make compost.

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[4] Note: compost piles in densely populated urban areas can attract roaches, rats, and other pests.

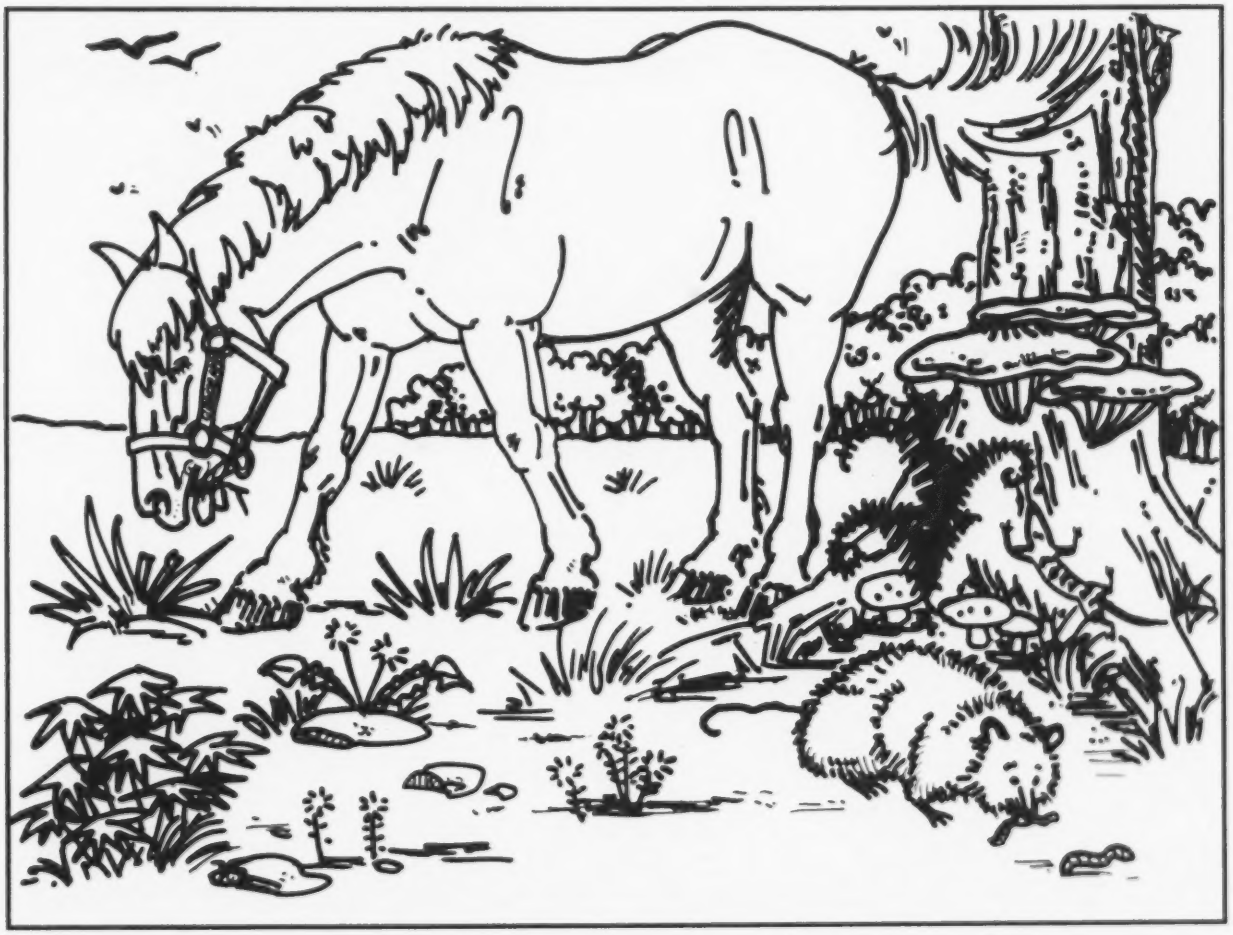
MAKERS, EATERS, & BREAKERS

Green plants make food, using water, carbon dioxide, and sunlight. They are the food ***makers*** of the earth.

Eaters are the animals that munch on plants and other animals. You are an eater! Horses, oppossums, squirrels and salamanders are also eaters.

Worms, mushrooms, and bacteria are ***breakers***. They feed on dead plants and animals. This helps make new nutrients for the soil that will be used by the makers.

In the picture below, color the makers green, the eaters blue, and the breakers red.



Chapter 5 Cycles and Flows

Chapter Background

Cycles and flows move and shape the earth. Water and nutrients cycle through ecosystems. Energy flows one way through a system. These processes shape our lives and our world.

The hydrologic cycle is the dramatic process by which water moves between the atmosphere and the earth. Precipitation falls to the earth, sometimes in torrents, sometimes in gray drizzle. It either runs over the surface of the earth to meet rivers and lakes or is absorbed by the soil, joining groundwater in aquifers. Rain eventually meets the ocean. Water evaporates from the ocean, joining the sky again to form clouds and rain. The cycling of water in and out of the atmosphere helps determine climatic patterns.

Oceans hold about 97 percent of the water on earth. Only about 1 percent of the water on earth is available as fresh water. The water that is here today has been used many times before—perhaps by pterodactyls for drinking and brontosauruses for bathing.

The quality of water affects the ability of plants and animals to survive. Artificial and natural pollution can render a water body undrinkable, unfishable, or unswimmable. Water does have some ability to recover from pollution, by diluting and flushing contaminants. However, many toxic materials such as metals and industrial chemicals become part of river or lake bottoms. Some pollution may become an unwelcome visitor for many generations.

While water is essential for sustaining life, the ultimate source of movement on the earth begins with the sun. Light energy from the sun moves through the earth's atmosphere. This energy reaches a green leaf and fuels the conversion of carbon dioxide and water into sugar (glucose). The glucose is stored in plants. Energy from the sun also heats the land, water, and air at different rates, producing air movements called wind. The sun powers the hydrologic cycle and ocean currents. Energy must be available constantly to sustain ecosystems.

Very young children may understand little about cycles and flows in nature. They may understand that water disappears or that they need food when they are hungry. But even young children can begin to comprehend repeating patterns. Seasons follow one another in a discernible way. Rain comes down and makes puddles, and these puddles disappear. Many things in nature are cyclical or repeat. Helping children understand this wonder will help them pick out patterns and flows in the world.

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Activity 5 • *Ice Cubes Away!*

Objective

To observe and describe evaporation.

Activity Summary

During hot weather, children put an ice cube, popsicle, lemon slice, and rock on the sidewalk, observing changes. They then draw a picture, telling a story about an item that changed.

Doing the Activity

Start by dividing children into teams of two. Explain to the teams that they are scientists! Scientists watch and tell others what happens to things. Now ask your entire group if they know where rain comes from. Let them list different ideas. Most will know that rain comes from clouds. Ask the children where the clouds get water. Again, let them list their ideas. Explain that as scientists, they will be doing experiments to see if their ideas are right.

Remember that this activity must be done on a warm or hot day. The hotter the better, since items will melt quickly enough to hold the interest of the group.

Take children outdoors to a concrete sidewalk. Give each team an ice cube, a piece of popsicle, a rock, and a lemon slice. Also give them art paper and crayons or markers. Ask teams if any of the things you've given them can give water to clouds. Which ones? Ask them to test their ideas. Let them put the items on the sidewalk. Using their powers of observation, they should draw anything that starts to happen to the items. Is the ice cube sliding around? Is the popsicle turning into a purple puddle? Is the rock doing anything?

Let your teams observe and draw the items for several minutes. Depending on the temperature, the ice cube and popsicle should melt within this period. Ask the children where the ice cube and popsicle went. (They should be able to figure out that they are puddles.) Do they think the ice cube and popsicle would become puddles if they were in a freezer? What is the difference between a freezer and the sidewalk?

After several minutes, the puddles should grow smaller (evaporate). (This may not be obvious.) Ask the teams again to watch the items and puddles, looking for changes. Is anything happening to the rock? The lemon slice (is it shriveling)? How about the puddles? Ask your teams if they know where the water from the puddles is going. Do they see any

Life Skills: trying new things, building a base of experience, listening, working together cooperatively, gathering information to solve problems, practicing problem solving, developing intellectual curiosity, asking questions, predicting outcomes of situations

Size of Group: any

Ages: five to six

Minimum Adult-to-Child Ratio: 1:6

Location: outdoors

Time Needed: 25 minutes

Best Time of Year: during hot weather

Materials: ice cubes, popsicles, lemon slices, rocks, art paper, crayons or markers

Option: Put a cup of water outside for a week. Observe it every day at the same time, and mark the level with a marker. What happens each day? How long does it take to disappear? Does it disappear, or just change forms?

steam rising off the sidewalk? (This might happen on a very hot day.)

Let teams share their ideas, drawings, and observations with the others. Be sure that they pick up the lemon slices and rocks before returning to the meeting or class area. They also may want to wash or rinse the puddles off the sidewalks.

Evaluation

Do you think that rocks disappear into the sky? How about baseball bats? Do you think that the water that goes into the sky ever comes back to the ground again? How? Do you ever see water go up into the sky, like backwards rain? Why not? How does water get back to the clouds?

Being a Steward of the Environment Means . . .

knowing that water is important! Don't drop wrappers, pop cans, food, or other litter in lakes or streams. Don't drop litter in the streets, either! Some of this litter ends up in storm sewers. Storm sewers dump water and litter into ponds. So pick up litter! This will help keep lakes and streams pretty and clean.

You can also conserve water. In some areas of the United States water is very scarce. In other places, there seems to be plenty of water. Wherever you live, it makes good sense not to waste water. Don't leave water running when you brush your teeth. Don't let anybody in your family water the sidewalk. And make sure the dishwasher or washing machine is full before starting another load.

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Activity 5 Let It Snow, Let It Snow, Let It Snow!

Objective

To understand that events in nature have a pattern.

Activity Summary

Children become weather forecasters. They track the weather for several days, and then predict what the weather will be like the next day.

Doing the Activity

Explain to children that some events in nature have a repeating pattern. Water falls to the ground as rain or snow, then disappears when it is turned into a gas (vapor) and forms clouds. These clouds again bring rain or snow. What other things can the children name that are examples of repeating patterns in nature?

Seasons repeat in a pattern. Ask children what season follows spring. Winter? Summer? Autumn? Why do they think that it is cold in the winter and warm in the summer? Why is snow likely in January but unlikely in July? Can it be freezing cold one day and very hot the next?

Explain that weather changes some from day to day, but factors such as temperature, rainfall, and snowfall tend to be high, low or medium during certain months of the year. Though weather patterns can change, the days within a seasons are generally similar within a range of temperatures. Ask children if they think it is hard to predict what the weather will be like tomorrow. Are there some clues they can use to understand weather and patterns?

Ask children if they would like to be weather forecasters. Can they describe what forecasters do? How do forecasters know what it will be like the next day? Do they just guess? Or do they look for patterns?

Hand out Activity Sheet 5. For each day of the week (or each meeting day), children should find the weather forecast, including the high temperature, low temperature, and whether it will be sunny, cloudy, rainy, or snowing. They can find this information from radio, television, or the newspaper. Discuss these different sources with the children. Explain that it will be their responsibility to check and record the weather forecast for five consecutive days (or times). This means that they'll need to record on the same activity sheet at least five times.

Using the weather forecasts they

Life Skills: trying new things, testing oneself, building a base of experience, listening, gathering information to solve problems, practicing problem solving, developing intellectual curiosity, identifying resources, predicting outcomes of situations, learning to use tools and other objects

Size of Group: any

Ages: seven to eight

Minimum Adult-to-Child Ratio: 1:6

Location: indoors

Time Needed: several days, 20 minutes each day

Best Time of Year: any

Materials: copies of Activity Sheet 5, pencils

have recorded, come to a group consensus each session about what the weather will be like. This may not be as easy as it sounds! Even weather professionals in the same city don't always agree on the day's forecast. Check the group prediction against the actual highs, lows, and other weather information the following day. How close were the predictions to the actual weather? (If there is one available, check an outdoor thermometer at each session.) Let everyone write the actual highs, lows, and weather on their sheets.

After they have recorded their fifth forecast, tell the children that they will now become weather forecasters. They need to predict what the weather will be like the next time your group meets. Give them a few minutes to predict the weather and record their prediction on Activity Sheet 5.

Now let each child give their "weather report" to the rest of the group. Record each high and low temperature guess, and whether the day will be cloudy, sunny, etc. Estimate the mean high and low predicted temperatures (or use a group estimate).

When participants next reassemble, see how close they were to the actual weather forecast for that day. Was the mean (group estimate) close to the actual reading? What was the closest prediction?

Ask the children what their favorite weather is like. Is it sunny? Windy? Snowy? Would it be okay if it were always 80° and sunny outside? Why or why not? What would happen if it snowed everyday and never got above freezing? What would happen to the plants and animals in your area?

Evaluation

Does weather seem to follow patterns? Describe some of these patterns. Is weather influenced by the water cycle? How? Would you like the weather to be always sunny and warm? Why or why not?

Being a Steward of the Environment Means . . .

telling others that water is essential to life on the planet. Water is a substance that cycles in nature, and it is responsible for much of the weather we have. Plants and animals could not live without rain and snow. You can protect some of the earth's valuable water by watching what goes into storm sewers. Storm sewers are the openings in the streets where rain water goes. This rain water eventually flows into ponds, lakes, or rivers in the area. If you drop a candy bar wrapper near a storm sewer, it could get washed into a nearby lake or river. So watch what goes into your neighborhood storm sewers. Tell others not to dump anything but water into them!

LET IT SNOW!

MONDAY

TEMPERATURE _____ degrees Fahrenheit (° F.)

Daily High: _____ Daily Low: _____

Predicted: High: _____ Low: _____

What really happened? _____

Circle today's forecast:

SUNNY

RAINY

CLOUDY

SNOWY

TUESDAY

TEMPERATURE _____ degrees Fahrenheit (° F.)

Daily High: _____ Daily Low: _____

Predicted: High: _____ Low: _____

What really happened? _____

Circle today's forecast:

SUNNY

RAINY

CLOUDY

SNOWY

WEDNESDAY

TEMPERATURE _____ degrees Fahrenheit (° F.)

Daily High: _____ Daily Low: _____

Predicted: High: _____ Low: _____

What really happened? _____

Circle today's forecast:

SUNNY

RAINY

CLOUDY

SNOWY

THURSDAY

TEMPERATURE _____ degrees Fahrenheit (° F.)

Daily High: _____ Daily Low: _____

Predicted: High: _____ Low: _____

What really happened? _____

Circle today's forecast:

SUNNY

RAINY

CLOUDY

SNOWY

FRIDAY

TEMPERATURE _____ degrees Fahrenheit (° F.)

Daily High: _____ Daily Low: _____

Predicted: High: _____ Low: _____

What really happened? _____

Circle today's forecast:

SUNNY

RAINY

CLOUDY

SNOWY

Activity 5 Ocean Energy

Life Skills: building a base of experience, gathering information to solve problems, developing intellectual curiosity, asking questions, refining small motor skills

Size of Group: any

Ages: five to eight

Minimum Adult-to-Child Ratio: 1:6

Location: indoors

Time Needed: 25 minutes

Best Time of Year: any

Materials: copies of Activity Sheet 5, crayons or markers

Objective

To trace the flow of energy through an ecosystem.

Activity Summary

Children color Activity Sheet 5, tracing the flow of energy through an ecosystem. They then draw a picture of themselves using energy.

Doing the Activity

Food provides chemical energy that helps living things grow, reproduce, and do other tasks. The source of all food is the sun, which gives basic energy for life. Explain to participants that when an animal eats a plant, it uses the energy in the plant to move and do other things. Ask children to list some things they do after eating a peanut butter and jelly sandwich for lunch. Do they jump rope? Play baseball? Run? Hop? They can do these things because they ate energy!

Ask your group where energy comes from, and help them to understand that the ultimate source is the sun. Explain that energy, unlike nutrients and water, does not cycle. Energy flows one way through a system. Some energy is lost at each step of the food chain, mostly into the air as heat.

Give children copies of Activity Sheet 5. Ask them to trace the flow of energy through this ocean scene, starting with the sun. They can then color the picture.

After they have finished coloring the picture, ask children to turn the pages over and draw pictures of themselves getting and using energy. What do they eat to get energy? How do they use the energy? Do we use sun energy for things other than growing food? Can they name some ways we use sun energy?

Display the pictures around the room after they have finished.

Evaluation

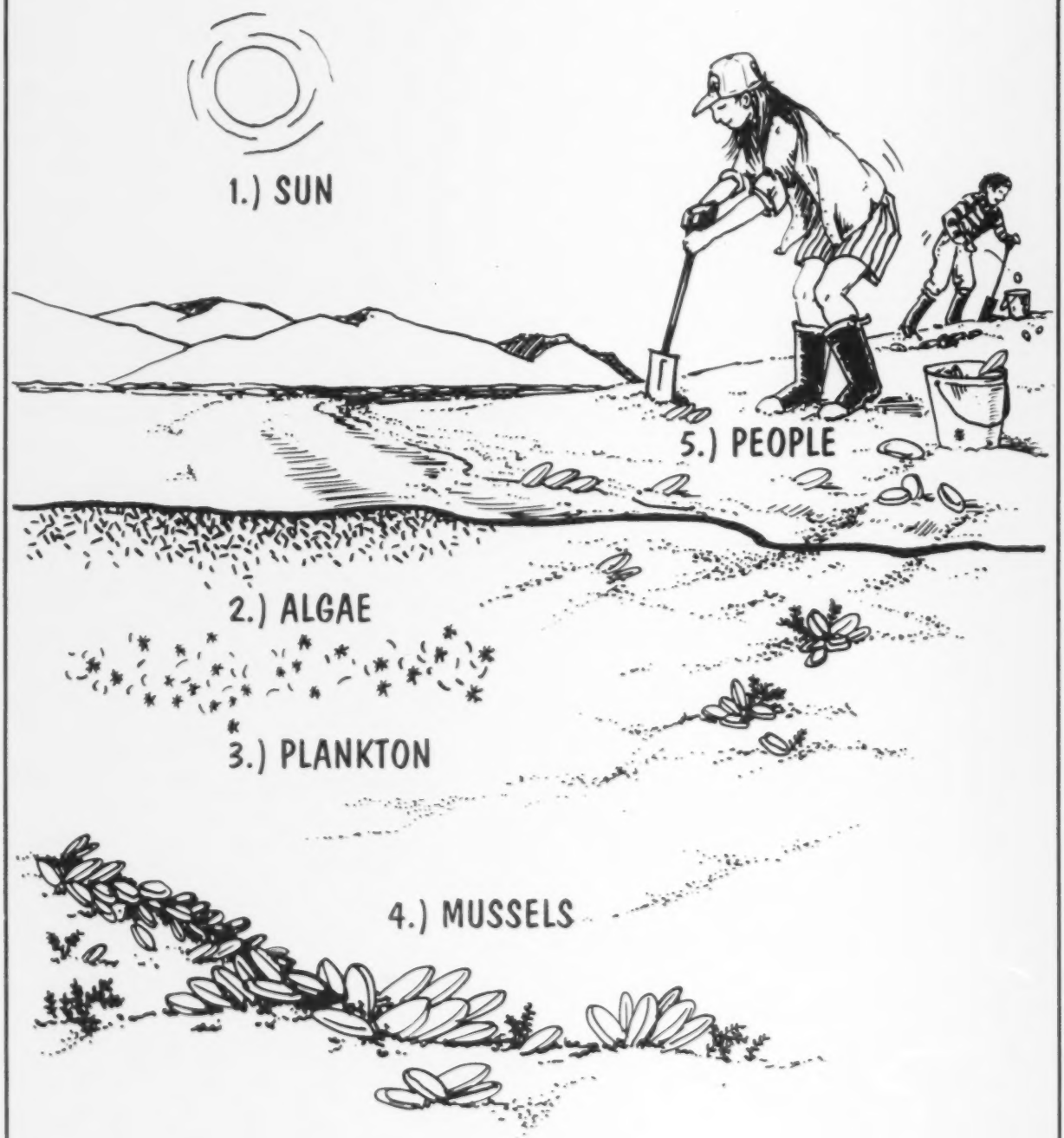
Where do plants get the energy they need to make food? Where do we get energy? How do we use energy? Do we use energy even when we are sleeping?

Being a Steward of the Environment Means . . .

understanding more about energy! Some of the energy we use in our homes and cars comes from fossils. Oil, natural gas, and coal are fossil fuels. Look for ways to save energy around your home. Go on a light patrol and turn off extra lights. Ask everyone in your home to wear sweaters if they are cold and turn down the thermostat (dial that controls the furnace). Look for other ways to save energy!

AN OCEAN OF ENERGY

Start at the sun and draw a line to show how energy moves in the ocean. Then color your picture.



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Chapter 6

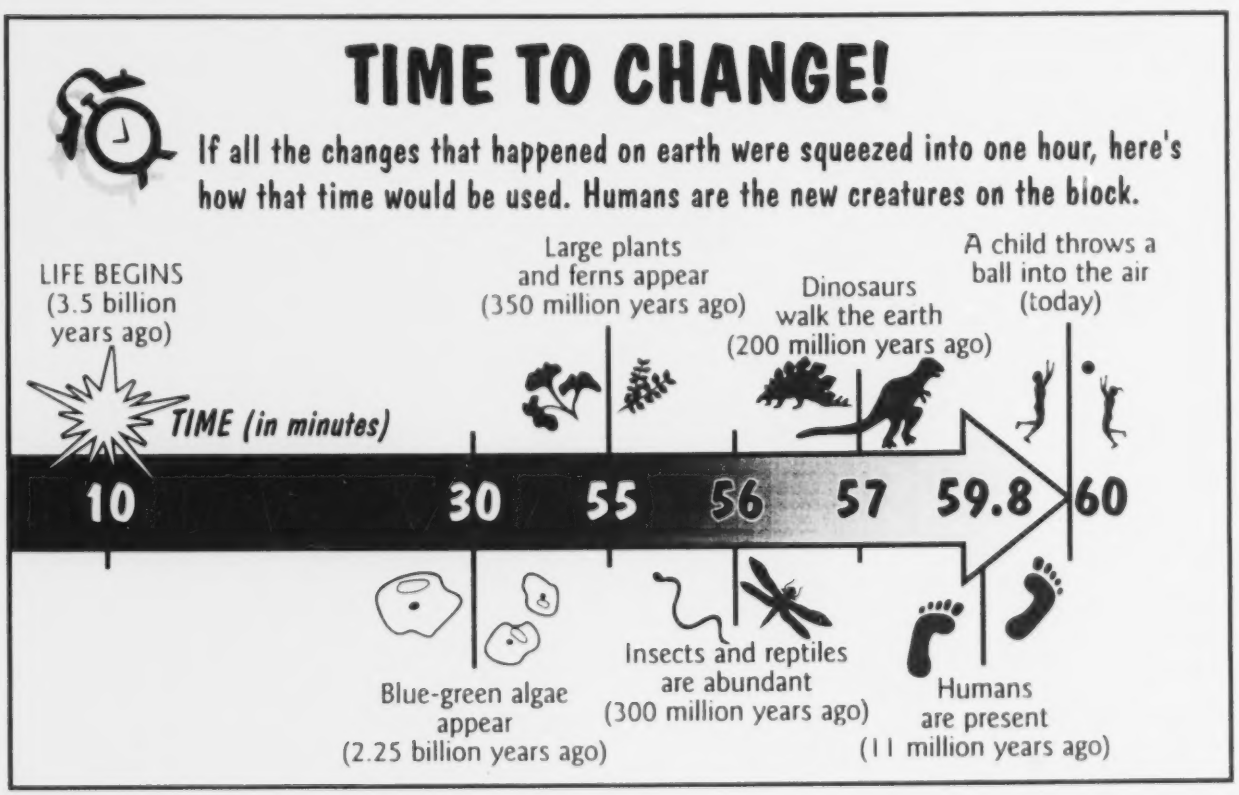
Blowing in the Wind

Chapter Background

Things change in nature. Bogs turn into forests. Bare sand is taken over by jack pine groves. Rocks and lichens give way to ferns, forbs, and grasses. This change over time of the function and structure of an ecosystem is known as succession. Succession can take hundreds, thousands, or even millions of years, but one thing is clear. Things don't stay the same.

Plant communities aren't the only things that change. Birds and other animals also undergo succession. However, this usually is the result of changes in plant types and abundance. At the same time, animals, including birds, have a large impact on how habitats and ecosystems change. They introduce seeds from faraway areas. They affect soils by burrowing and turning soil. They eat plants, either speeding up succession or starting it over again.

So what? What does succession have to do with humans, or vice


TIME TO CHANGE!
If all the changes that happened on earth were squeezed into one hour, here's how that time would be used. Humans are the new creatures on the block.
LIFE BEGINS (3.5 billion years ago)
Large plants and ferns appear (350 million years ago)
Dinosaurs walk the earth (200 million years ago)
A child throws a ball into the air (today)
TIME (in minutes)
10
30
55
56
57
59.8
60
Blue-green algae appear (2.25 billion years ago)
Insects and reptiles are abundant (300 million years ago)
Humans are present (11 million years ago)

versa? Well, sometimes, the things we do to natural systems interrupt succession. We hold natural development in check, or we start it over. When farmers plow and plant fields, they are starting succession over again. When we manage a forest for certain tree species such as oak, we hold the system where it is for long periods of time. When we limit succession by growing communities composed of single species (monocultures), we may create relatively unstable systems that can suffer severe losses from insects, diseases, or drought.

An important idea for adults and children to grasp is that habitats in nature change with or without human intervention. As much as we would like to, we can't freeze-frame old-growth forests, waterfowl-laden marshes, or fields alive with blazing star. These habitats eventually undergo the natural process of succession.

Change is all around a child. The child is rapidly growing and maturing. Family members are changing. We cannot stop living things from changing. The earth is dramatically different now than it was 15,000 years ago. It will continue to evolve well into the future.

Activity 6 Seed Sock Hop

Life Skills: trying new things, building a base of experiences, expressing creativity, understanding diversity, developing intellectual curiosity, using large muscles, refining small motor skills, learning to use tools and other objects

Size of Group: any

Ages: five to eight

Minimum Adult-to-Child Ratio: 1:6

Location: outdoors in a wooded area or overgrown lot with weeds, bushes, and other sources of sticky seeds

Time Needed: 45 minutes

Best Time of Year: spring, summer, or fall

Materials: wool or nylon socks (have children bring from home), crayons or markers, art paper, small paper or plastic bags, glue sticks. Optional: tweezers

Objective

To investigate how seeds move from one location to the next.

Activity Summary

Children visit a wooded area or empty lot and collect seeds using socks pulled over their shoes. They also collect other seeds in the area. They examine the seeds they have collected. Finally, they glue their seeds to a drawing of a sock.

Doing the Activity

Find a wooded area or large overgrown lot with many shrubs, weeds, and other plants. Check the site before you take participants to the location to make sure there are ample supplies of "sticky" seeds. These seeds can be found on weeds and bushes. They will cling to wool socks, nylons, or sweaters when touched. If you are visiting an empty lot, make sure it is safe from glass and other dangerous debris. Note: you'll need to request that children bring socks to your meeting or class, or have ample supplies ready to begin the activity.

To start the activity, ask children if they have ever seen a seed. Do seeds move? How do seeds get from one place to another? Let them name some ways they may have observed seeds traveling. Explain to the children that you will be going outside to collect seeds. They'll need to don the socks over their shoes. Give each child a small paper or plastic bag in which to put collected seeds.

At the site, do a "sock hop" through the wooded area or field. You can make up any type of dance, hop, or pattern you like. The children will be trying to collect seeds that are specially adapted to hitchhiking on clothes or animal fur. These seeds should stick to the socks.

Children also should look for other seeds, collecting them in their bags. They might find maple samaras, acorns, pinecones, or other examples.

Back at the meeting area, have children remove their socks. Divide them into teams of two or three, and have them carefully remove the seeds from the socks and put the seeds onto a sheet of newspaper. Let them use tweezers, pencils, and other objects to dissect a few of the seeds. Let children share what they have found. Ask them if they thought it was easy to find seeds. Where did they find most of the seeds? What is the most unusual seed they found?

Ask the children if they think

that seeds are living or nonliving. What type of plants will the seeds grow into? How does each seed move? Can seeds travel a long way?

Ask them to imagine a forest fire or other disturbance. Imagine that all the trees, bushes, and other plants are gone. Which of the seeds in their collection could get to this burned area? Which could start the forest over? Seeds that can hitchhike? Float on air? Move by water? Can seeds be moved after they have been eaten by animals? Let them explain any theories they may have.

Now ask children to categorize their seeds according to how they move—for example, hitchhikers, floaters, and flyers. Pass out art paper and crayons or markers. Ask them to draw a large sock and glue the hitchhiking seeds onto the drawing. They also can attach the other seeds to the picture if they like. Be sure to display the sock art for everyone to enjoy!

Evaluation

How do seeds move? Can seeds grow a new forest? Do you think you would find seeds on the moon? Why or why not? Do you think there are many seeds in the world? How many do you think actually grow into plants, including trees?

Being a Steward of the Environment Means . . .

planting shrubs and trees with edible seeds for wildlife! Birds like to eat berries. Squirrels and other animals like to eat acorns. Ask your parent if you can plant a bush or tree with acorns or berries in your yard or neighborhood. The people at your local tree nursery can show you native plants with edible seeds that attract wildlife. Or you may want to tackle a larger project and get permission to plant in parks or neighborhoods.

Option: instead of a sock, children may draw another medium for the hitchhiking seeds—e.g., a dog or raccoon.

Activity 6 Old Field

Objective

To gain awareness of how ecosystems undergo succession.

Activity Summary

Children play a board game that helps them understand how fields change into forests.

Doing the Activity

Start by reminding children that places in nature change. Sometimes tornadoes rip up trees. Sometimes wetlands fill with soil and become land. All habitats change. Ask for other examples of how nature changes things. Be sure to remind the children that while some changes happen very fast, others happen very, very slowly.

Divide the children into teams of four to six. Play the Old Field game found on Activity Sheet 6. (Note: each team will need a gameboard, dice, and playing pieces.) If all the children are nonreaders, pair a teen or adult with each team to read the squares. Older children can read the game themselves.

When participants are finished, ask if they can explain how old fields become forests. What happens first? How long does the maple have to wait before it can grow on the field? Why does it have to wait? (It needs shade.)

Did anyone have to go back to start? Why? Does nature sometimes start things all over again? Can anyone name some examples of things that happen in nature to start habitats over again? (Fire, tornadoes, hurricanes.) Do humans ever start habitats over? How might they do this? (Logging, burning areas, plowing fields, building roads and houses, etc.) Do habitats change quickly or slowly?

Ask the children to close their eyes and imagine their favorite place outside. Does it have trees? Shrubs? Lakes? Rivers? After a few seconds, ask them if they think that place will look exactly the same in three years. Twenty? A hundred? Ask the children if they are changing. Will they look the same in three years? Twenty? A hundred?

Evaluation

How do old fields or other pieces of land change? How do habitats change? Can nature change habitats? Can people change habitats? How?

Being a Steward of the Environment Means . . .

looking at issues scientifically. Don't just listen to what people say. Read about the issue. Look at different viewpoints. Then make up your mind. For example, some people don't want to cut forests because they are afraid it will change them. But can people keep forests the same forever? And can we live without the wood that forests provide? It's important to know how forests work. Then you will know what you are talking about!

Life Skills: trying new things, listening, working together cooperatively, sharing, resolving conflicts, developing intellectual curiosity, using common sense, refining small motor skills

Size of Group: any

Ages: five to eight

Minimum Adult-to-Child Ratio: 1:6

Location: indoors or outdoors

Time Needed: 30 minutes

Best Time of Year: any

Materials: copies of gameboard found on Activity Sheet 6 (you might want to mount them on cardboard for durability), dice, playing pieces (jelly beans, colored paper clips, or other items)

THE OLD FIELD GAME

You are a maple tree that is trying to grow in this field.
Start at year one and follow the leaves.

YEAR 1
Farmer decides to stop growing food on this field.
MOVE AHEAD 2 SPACES

YEAR 4
Grass seeds take root in the field. They use the space you wanted.
MOVE BACK 2 SPACES

YEAR 20
Some woody shrubs start to grow in the field. They give lots of shade. That's GOOD for a maple.
MOVE AHEAD 3 SPACES

YEAR 40
Oops! A fire that was started by a chainsaw burns the field. It's time to start over!
GO BACK TO START

YEAR 50
Oak trees begin to grow in the field. Maples really like the shade from these oaks!
MOVE AHEAD 4 SPACES

YEAR 125

The oaks are getting older. Now's your chance! Grow in the shade of the oak trees!

MOVE AHEAD 4 SPACES

YEAR 200

You're a big tall maple tree now. You live where the farmer once grew food. You have made lots of new maples from seeds. They are all around you. They will grow strong in your shade.

START OVER AGAIN!

YEAR 175

Some of the oaks are dying. Maple trees are getting bigger because now they can reach more sunlight.

MOVE AHEAD 3 SPACES

YEAR 160

Here comes somebody who is going to cut down all the trees! But wait - they're only cutting a few of the oaks. They are trying to grow new oaks. New oaks will grow out of the stumps of old oaks.

MOVE AHEAD 3 SPACES

Activity 6 Sun Lovers and Shade Lovers

Objective

To understand that ecosystems such as forests, wetlands, and prairies change over time.

Activity Summary

Children explore forest succession by examining shade and sun loving plants in a small woodlot. They identify shade lovers and sun lovers with yellow and blue ribbons. They then hypothesize which plants would invade a cleared site and which ones would grow in the shade. They also determine how old the forest is. Finally, they draw pictures of a future forest.

Starting the Activity

Identify a nearby woodlot that children can examine. This should be a small forest that is somewhat natural. It should have a canopy (upper layer of trees), understory (bushes and small trees underneath the canopy), and forest floor with seedlings and other plants.

Ask the children if they think they've changed in the last year. Can they give examples of any changes? Has anything in their home—their habitat—changed recently? Do all habitats change? Let them offer some ideas on why habitats do or don't change. You can cite a new example such as a local forest or wetland and ask your group if this area has changed. How?

After you have discussed personal and habitat change, take the children to the woodlot. Divide them into teams of two. Explain to the teams that they will be searching a forest for clues to discover if it is old or young.

Look closely at the seedlings and small trees growing underneath large ones (you'll find maple, fir, beech, hickory, etc., depending on your location). Point out to teams that leaves are a clue to their mystery! Leaves can tell whether trees are in the same family. Let the teams examine the area to find seedlings from the same family.

Ask the children if they think the seedlings get lots of light. You may find that there are some holes in the canopy where light streams through, but generally these seedlings don't get lots of direct sunlight. Ask the children if they think these seedlings love the shade or sun. (Because they are growing under a dense canopy, they are shade loving plants.)

Give teams blue ribbons and have them tie one around every seedling they think is a shade lover. (They may tie ribbons around plants other than trees, but that's okay.) Make sure that you take a few minutes to let

Life Skills: building a base of experience, working together cooperatively, gathering information to solve problems, developing intellectual curiosity, predicting outcomes of situations, refining small motor skills

Size of Group: any

Ages: seven to eight

Minimum Adult-to-Child Ratio: 1:6

Location: outdoors near a woodlot or group of trees

Time Needed: 30 minutes

Best Time of Year: when leaves are on trees

Materials: yellow and blue ribbons, chalkboard or large paper, art paper, markers or crayons. Optional: clay, styrofoam, or other art materials

teams see the results and share their observations about shade loving plants. Are there lots of shade loving trees and plants in your forest?

Now ask your teams to find plants that are sun lovers. The sun lovers are the trees that can reach up and get the most sun. This means that they are in the canopy, or top layer, of the forest. Let your teams tie yellow ribbons around any trees that are receiving mostly full sunlight. Explain that these trees are sun lovers. They love to grow where there is lots of sun.

Let your teams gather some leaves from these tall trees, and compare with the seedling leaves. Are they the same type of tree? If they are, then you are in a climax forest. In a climax forest, the trees at the top are the same as the smaller ones. It usually takes many years to make a climax forest. This forest will look pretty much the same until something dramatic happens—a fire, tornado, harvest, etc.

If the tall trees and the seedlings don't have the same type of leaf, then you're in a (ecologically) younger forest. Are there many sun loving plants and trees in your forest?

Ask participants which type of tree would grow on land that had trees removed—the sun lovers or shade lovers? (Sun lovers.) Which trees would grow underneath these trees once they got big? (Shade lovers.) Why? (Because the bigger trees would provide shade for the shade lovers.)

Pass out art paper and crayons or markers to everyone. Ask them to draw a picture of what their forest will look like in 50 years (when they are 58!). Let them add animals that live in their forests. They can work with their team partner on one larger drawing if they wish. Let the children or teams describe their drawings. Display the forests for everyone to see!

Option: children can use clay or other mediums to vision their future forest. They can build a model using styrofoam and small twigs, moss, and glue.

Evaluation

Do forests change by themselves? How? Do you think that other habitats also change? Does a prairie change? A wetland? A meadow? A city lot? If left alone, would every place eventually become a forest? Why or why not? (Probably not, at least until weather patterns change. There are some places on earth that are too dry or too cold to support vegetation. However, massive shifts in precipitation amounts or weather patterns could change these situations.)

Being a Steward of the Environment Means . . .

understanding that things change in nature. Sometimes they change because of human actions. But everything changes even if no humans are around. Plants and animals age and die. Fires, tornadoes, hurricanes, and other events cause quick change to a habitat. As much as we'd sometimes like to, we can't keep things from changing.

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Chapter 7 Can It Grow Again?

Chapter Background

The earth is currently the host to more than five and a half billion people. Developing and developed countries alike continue to grow. As populations enlarge, so do our needs for natural resources. In the United States, more minerals and fossil fuels have been used since 1950 than in all the eons of time before that year. Reserves of essential minerals and metals—tin, zinc, silver, mercury, etc.—continue to be used to make products that humans want or need. Fossil fuels are not renewable in the sense that it takes thousands of years to produce these reserves. While estimates differ regarding how much is left, it is clear that new sources of energy must be identified during the next century.

But not all resources are finite. Indeed, some, like wood, can be grown again within a lifetime or two. These renewable resources can be used instead of ones that cannot be grown again. For example, paper bags are made from renewable resources (trees), while plastic bags are made from nonrenewable resources (fossil fuels). Wildlife populations generally can be rebuilt when their numbers dwindle. They too can be considered renewable. But since the loss of old-growth forests and their functions and the extinction of animals species can have untold effects on the functioning of ecosystems, renewable resources must be used very, very carefully.

In developed countries, there is a tendency to throw things away rather than look for other uses. As a result, our landfills fill up and our incinerators operate continuously. We seldom pause to see how our garbage could be reused. In the future, we may be mining our landfills for energy and other resources!

Children can understand basic concepts of waste and resource, renewable and nonrenewable, and needs and wants. They can see that eggshells can become fertilizer, that plants can grow again, and that sometimes what they think are needs are really wants.

Activity 7

Tree Nurseries

Life Skills: trying new things, building a base of experience, gathering information to solve problems, developing intellectual curiosity, identify resources, predicting outcomes of situations, using large muscles, learning to use tools and other objects

Size of Group: any

Ages: seven to eight

Minimum Adult-to-Child Ratio: 1:6

Location: indoors and outdoors near seed-producing trees

Time Needed: 1 hour initially; up to six weeks for observation

Best Time of Year: when seeds are ripe—spring, summer, or fall

Materials: paper bags, clay pots (or egg cartons), soil, tweezers.

Optional: apple picker or broomstick

Objective

To investigate whether trees can be grown again.

Activity Summary

Children plant seeds from trees to find out whether they will germinate and grow into a new tree.

Doing the Activity

Can we grow forests again? While it might take a long time, the answer generally is yes—we can regrow forests. Foresters often plant the same types of trees that were growing on a site before it was logged. But there are exceptions. Certain very old forests—called old growth or ancient forests—have developed into complex ecosystems. Once these systems are harvested, it may take hundreds of years to even begin to replace their functions. Also, some trees take a very long time to grow in an area because the site is particularly harsh. When these trees are cut it may take a long time to restart the forest.

Start this activity by polling children. Ask them if they think we should harvest (cut) trees. Let them explain their views to the rest of the group.

Ask the children if they think trees can be regrown. Explain that trees are renewable resources—they can be regrown. To investigate this idea, you will be collecting seeds from trees and trying to get them to grow new trees. Note: if you don't live in an area with seed-producing trees, contact your state department of natural resources or nursery to find out how you can order seeds.

Check the table below for some common species and the season for collection. Then lead your group to an outdoor area where there are seed-producing trees. Give each person a paper bag, and let him or her collect three or four different seeds (e.g., acorns, pinecone seeds, samaras, nuts). Note: some seeds will need to be collected from the trees. An apple-picker or broomstick can be used to knock seeds and cones down. You also can collect seeds from the ground.

A few seeds will require some action to ready them for germination. It is usually accomplished by weather or by animals. Let participants follow the instructions on the next page for collecting and getting their seeds ready to germinate with your help.

Species	Seed Ripens	Getting Ready to Germinate Techniques	Special Notes
Black maple, bigleaf maple, sugar maple	late summer-early fall	none required	Seed doesn't store well.
Red maple, silver maple	spring	none required	Seed doesn't store well.
Black oak, bur oak, chestnut oak, red oak, other oaks	fall	none required	Seeds within acorns may be damaged by insects, so plant more than one. Some oak seeds can take a month or longer to germinate. Don't harvest acorns from trees—they may not be ripe. Instead, gather them from the ground, preferably shortly after they have fallen. White oak acorns may already have started to germinate by the time they are gathered.
White pine[5], loblolly pine, longleaf pine, pinyon pine, pitch pine, ponderosa pine, other pines	late summer-fall	For white pine: Store seeds between lightly damp paper towels in refrigerator for three weeks. Do not keep them in the coldest part of the refrigerator—they need temperatures around 40°F. For other pine: none required	You'll need to harvest the cone from the tree—look for cones that are brown and are starting to drop. Most of the cones on the ground will already have shed seeds. Seeds are located within the cone under the bracts. Gently remove them with a tweezers or knife.

Planting instructions: Let children get seeds ready to germinate, if necessary, and remove seeds from cones.

[5] Jack pine and lodgepole pine are not recommended for this activity. These trees generally have serotinous cones, which need fire or heat to open.

Children can prepare clay pots by filling with potting soil or mineral soil gathered from the woods. Cover the seeds with a scant 1/4 inch of soil. Be sure to keep the soil slightly damp. Keep the seed in a sunny window at about 65-70°F. Each person should plant at least five seeds.

Some seeds will take three weeks or longer to germinate. Others may not germinate at all if they have been damaged by insect or disease. Let children check their mini-forests every few days. Let them observe what types of seedlings are starting to develop.

During the activity, ask your group if they think it is hard to regrow a forest. What things might affect whether a tree can survive? Does every seed become a tree? Why or why not? Should people plant trees after they harvest a forest?

After the seedlings have grown for several weeks, children can plant the trees outside in a protected area. (Or if they wish, they may grow them inside in pots for a few years.) You can track the progress of your mini-forest over the next few months and years. Tips for keeping your small trees alive outdoors:

- Plant in the spring. (If they were held over the winter indoors, harden them first by setting them outside for longer periods of time each day).
- Plant in a spot that receives some shade and some sun.
- Plant seedlings at least six feet from other trees.
- Water the seedlings regularly.

Evaluation

What are renewable resources? Can you name something that is renewable? Can you name an item we use that is not made from a renewable resource? Can forests be grown again? Why are forests important? Do they affect your life at all?

Being a Steward of the Environment Means . . .

understanding the difference between renewable and nonrenewable. Think about this the next time you choose a product. Is the packaging made out of something that can be grown again?

Activity 7

Rock Gardens

Objective

To differentiate between renewable and nonrenewable.

Activity Summary

Children examine different objects. They decide which items can be grown again.

Doing the Activity

Start the activity by asking participants to name things they know how to grow. What do they need to grow these things? Is it easy to grow them? Hard? Do the children think we can grow many, many different things?

Separate the children into teams of two or three each. Give each team the following items: a rock, a plastic bag, a paper bag, a potato, a sealed container of motor oil, a glass of water, a soft drink can, and a tree leaf. (Note: ask them to focus on the motor oil and water, not the containers, for these items.) Ask teams to separate the items into two groups: things that can be grown or made; and things that can't be grown or made. (Hint: ask teams to think about where these items originally came from.)

After they are finished, review the choices made by the teams. Let each team explain which items they think will grow again and which won't. (Note: fossil fuels and plastic bags can be made again, but it takes thousands of years. From a human perspective, these materials are nonrenewable.) Help the children understand where each item originates (such as the plastic bag or soft drink can).

Ask the children if they think it is a good idea to use things that we can grow again. Why or why not? Can they name some things that they use everyday that can be grown again? What can we do with items that we can't grow again to make sure we have enough? (Reduce use and recycle!)

Option: Let each team put together a "It Can Grow Again!" collage, using pictures from magazines (be sure to include a few nature publications). They can display their collages at a fair or other event.

Evaluation

Name two things that can be grown again. Name two things that can't be grown again. Does it sometimes take a long time to grow things again?

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recycling things that can't be grown again. Help the people in your home understand that things such as tin cans or glass bottles can't be grown again and need to be recycled. Then we will always have enough. It's a good idea to recycle things that can be grown again, too. This is because humans use a lot of renewable and nonrenewable things. Newspapers come from trees. But many areas recycle newspapers, too.

Life Skills: building a base of experience, expressing creativity, listening, working together cooperatively, sharing, gathering information to solve problems, identifying personal attitudes toward an issue, practicing problem solving, developing intellectual curiosity, asking questions

Size of Group: any

Ages: five to eight

Minimum Adult-to-Child Ratio: 1:6

Location: indoors or outdoors

Time Needed: 25 minutes; add 1 hour for optional activity

Best time of Year: any

Materials: potatoes, glasses of water, sealed containers of motor oil, rocks, plastic bags, paper bags, leaves. Optional: **glue, magazines, poster board, markers**

Activity 7 Where Does All the Wood Go?

Life Skills: **trying new things, working together cooperatively, resolving conflicts, gathering information to solve problems, practicing problem solving, developing intellectual curiosity, asking questions, predicting outcomes of situations, learning to use tools and other objects**

Size of Group: **any**

Ages: **seven to eight (adaptable for five- and six-year-olds)**

Minimum Adult-to-Child Ratio: **1:6**

Location: **indoors and outdoors at a forest**

Time Needed: **one hour initially; one to two hours for followup one week later**

Best Time of Year: **fall**

Materials: **large roll of fabric such as burlap, paper bags, weighing equipment, copies Activity Sheet 7, pencils**

Objective

To understand decomposition and nutrient recycling in a forest.

Activity Summary

Children visit an area with trees in the fall. This can be a forest or an urban area with at least five or six deciduous trees close together. Children stake fabric squares onto the forest floor. They then revisit the area in a week, collecting the debris (sticks, leaves, etc.) from their fabric squares. They calculate the amount of leaf fall. They try to figure out how much debris is produced in a forest, and where it goes. Note: this activity requires some multiplication and weighing. Adults and teen helpers can work with teams to help them weigh materials and complete the multiplication, or you can calculate the figures together as a large group.

Doing the Activity

How many sticks, leaves, branches, and other debris does a forest shed in the fall? And where does this material go? Children will investigate the answers to these two questions in this activity. To do this activity, you will need to locate a forest or area with a few trees that you can visit twice, approximately one week apart. You also will need permission to stake some fabric squares in the area. The forest you use should be somewhat undisturbed, so that your plots won't be bothered. You also may want to post a sign and hope that people won't bother your experiment!

Explain to participants that they will be using fabric squares to survey how much leaves, sticks, and other debris a forest produces in the fall. Separate children into teams of three or four each. Have each team cut a square of fabric measuring 2 feet, 11-1/2 inches on each side. This is about equal to a 1/5,000th acre (i.e., it would take 5,000 such squares to equal one acre).

At the forest, randomly select the spots where you will place the squares by closing your eyes and throwing a beanbag, orange, or other item into the forest. Choose a spot for each team. Random selection is an important idea in science.

Give each team a fabric square, a light hammer or rock, and four large nails (they do not have to be sharp, just bulky). Have teams nail down their pieces of fabric so they won't blow away (or have them anchor the fabric with four large rocks). Then give

each team a copy of Activity Sheet 7¼.

Ask each team to guess how many pounds of leaves, sticks, and other materials trees drop in one week during the fall. They should write their guesses on Activity Sheet 7¼. Ask the children where they think the leaves and sticks go during the winter and spring. Are the same leaves on the ground during the summer? Ask children to think back to a day in the summer. How many brown leaves and sticks are still on the ground during the summer? Where do these leaves and sticks go? (Leaves, sticks, and other debris are decomposed by fungi, bacteria, and other organisms, providing nutrients to the forest.)

Visit your forest a week later. Have teams carefully collect the debris from their fabric, and put it into a paper bag. They should then remove the fabric and bring it back with them.

Back at the indoor site, let teams carefully weigh their samples to get a total weight. It's best to use a scientific scale that can distinguish ounces. The samples should be dry. If they are not, put them on cookie sheets in the oven at a very low temperature for several minutes, or let them air-dry for a few days.

Each team should write the weight of its sample on Activity Sheet 7¼, then multiply that by 5,000 to get a per-acre total. (You might want to help convert this to pounds. For example, 15 ounces of forest debris, multiplied by 5,000, equals 75,000 ounces, divided by 16 equals 4,687 pounds).

How close is this number to their original estimates? Do the weights vary widely among teams? What is the biggest estimate or measurement? The smallest?

Ask participants what would happen if nature didn't recycle. How does a forest use the debris? Do they ever rake leaves at home and then put them into bags to throw away? What else could they do with the leaves?

Can your group name other things that people throw away that nature uses? How could they keep these things from being thrown away? How could they use them?

When you finish, return collected leaves and sticks back outdoors to be decomposed.

Note: To adapt this activity for younger children, simply dump the fabric squares full of leaves and sticks into a large pile. Discuss the amount of material that a forested area produces without going through the weighing and calculations.

Evaluation

Why does a forest recycle its nutrients? Does it need nutrients? What would happen if a forest didn't get to use dead leaves and sticks? Could it stay healthy?

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figuring out ways to use leaves from your yard or neighborhood! Don't put them in plastic bags and send them with the garbage truck. (That's not allowed in many communities anyway!) Spread them over gardens or plants to protect them during the winter, or put them in a wooded area, where decomposers will break them down into nutrients.

WHERE DOES ALL THE WOOD GO?

My name is:

How many pounds of leaves, sticks and other wood does an acre of this forest drop during one week in the Autumn?

write your guess here _____ **pounds.**

There were (circle one) **MANY** **FEW** leaves, sticks and other things on our burlap sheet.

WHAT DOES IT WEIGH?

1.) The weight of leaves, sticks and other materials on our plot was:

_____ **pounds.**

2.) Multiply that number by 5,000:

_____ **x 5,000 =** _____

This number is the total amount of leaves, sticks and other things dropped by the trees in this forest for one week in the Autumn on each acre.

3.) How close is this number to your original guess?

ONE ACRE

equals 43,560 square feet.
Imagine a giant cookie, 208.7 feet long on each side. That's a one acre cookie!

Glossary

arthropods: joint-legged animals that have a segmented external skeleton. These include crustaceans (e.g., crayfish), insects, spiders and mites.

biological diversity: the wealth of the world in terms of living things. Biological diversity is measured in numbers and types of species, genetic diversity within species, and richness of habitat.

canopy: the upper layer of trees.

carbon dioxide: a gas that is found in the air. Plants use carbon dioxide to make simple sugars that are the basis for the food chain. Humans exhale carbon dioxide.

climax forest: a forest in which young and old trees are of the same species.

consumers: animals that eat plants, animals, or both.

debris: in a wooded area, small organic items such as leaves, sticks, and moss.

deciduous: trees that lose their leaves in the fall or winter.

decomposers: organisms, such as earthworms and fungi, that break down organic matter into nutrients.

detritus: particles of organic matter that have been decomposed.

eaters: see consumers.

ecosystem: the interacting system of a biological community and its nonliving surroundings.

food chains: interdependencies between plants and animals, where animals eat other animals (or plants).

forest floor: the bottom of the forest that contains seedlings, grasses, mosses, fungi, and other small plants and animals.

habitat: the entire scope of environmental conditions of an area occupied by a living thing.

makers: see producers.

monocultures: plots containing a single plant species (e.g., a corn field or pine plantation).

predator: an animal that catches and eats another.

producers: green plants that produce food using sunlight, carbon dioxide, and water.

succession: the process in which an ecosystem changes in structure and function over time. Succession can be caused by humans or nature.

understory: the forest layer beneath the canopy.

woodlot: a small grouping of trees and other plants.

"NOTES"

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